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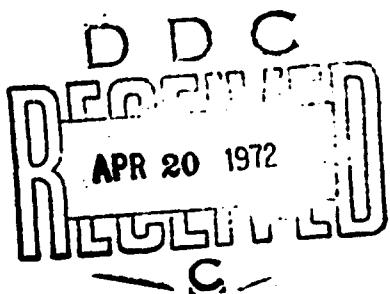
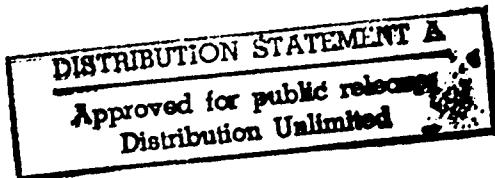
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THE QUANTITY AND QUALITY OF AIR FORCE  
VOLUNTEERS IN THE ABSENCE OF A DRAFT

By

Ralph B. Fritzsch, Captain, USAF

PERSONNEL ANALYSIS REPORT 71-005



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11. ABSTRACT: This study estimates the number and quality of individuals who would apply for Air Force enlistment under present conditions if the draft is eliminated. The subject population used is a 15 per cent sample for all individuals applying for Air Force enlistment in 1970, whether or not they actually were enlisted. A model based on the distribution of draft lottery numbers within the sample population was developed to determine the effect of eliminating the draft. It was estimated that 51.5 per cent of current applicants would apply for enlistment in the absence of a draft. To examine changes in the distribution of applicant mental quality (as measured by mental aptitude and years of education), the sample population was segregated into subgroups based on mental aptitude and also on years of education. Of present Cat IV applicants (the lowest mental category accepted for enlistment), 77.2 per cent would apply for enlistment in the absence of a draft, but only 38.1 per cent of Cat I applicants (the highest mental aptitude category) would apply. Likewise, 89.8 per cent of the present applicant group who did not finish high school would apply in the absence of a draft, while 24.6 per cent of the individuals with three to four years of college would still apply. A comparison of the quantity and mental quality of the applicant population expected in the absence of a draft with the Air Force's stated manpower quantity and quality requirements indicates that the Air Force will have difficulty meeting its requirements in the absence of a draft, especially in areas requiring higher mental aptitudes.

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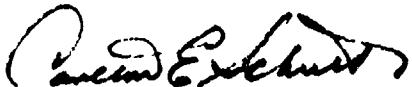
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## FOREWORD

This report documents the study completed in accordance with Research and Analysis Division Project Number 180 for the Policy Division, Directorate of Personnel Plans. The analysis was initiated on 15 December 1969 and completed on 1 December 1971.

The author of this report references a G. L. Brunner study, The Importance of Volunteer Status: An Analysis and Reliability Test of Survey Data, on pages 60, 66, and 75. This was not a final study report but a draft working copy of the study. The findings concerning the quality of volunteers differ substantially from those in the final report of the study which was published in December 1971. Therefore, the draft of the G. L. Brunner report as referenced in this study does not reflect the opinion of G. L. Brunner or RAND.

This document reflects the analysis of the author; it does not necessarily represent the official position or policies of the USAF.



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## ABSTRACT

This study estimates the number of individuals who would apply for Air Force enlistment under present conditions if the draft is eliminated. The distribution of applicant mental aptitude in the absence of a draft is also estimated. The subject population used is a 15 per cent sample of all individuals applying for Air Force enlistment in 1970, whether or not they actually were enlisted. Sex, date of birth, date of enlistment application, years of education, and percentile scores on the Airman Qualifying Examination (AQE) were recorded for each individual in the sample. A model based on the distribution of draft lottery numbers within the sample population was developed to determine the effect of eliminating the draft.

The proportion of current enlistees who would apply in the absence of a draft was estimated by dividing the number of enlistment applications expected in the absence of a draft by the number presently received. For the sample population examined, it was estimated that 51.5 per cent of current applicants would apply for enlistment in the absence of a draft. To examine changes in the distribution of applicant mental quality (as measured by mental aptitude and years of education), the sample population was segregated into subgroups based on mental aptitude and also on years of education. The percentage of applicants from each subgroup expected in the absence of a draft was then estimated using the procedure described above. The percentage of current applicants who would apply in the absence of a draft was inversely related to both mental aptitude and education. Of present Category IV applicants (the lowest mental category accepted for enlistment), 77.2 per cent would apply for enlistment in the absence of a draft, but only 38.1 per cent of Category I applicants (the highest mental aptitude category) would apply. Likewise, 89.8 per cent of the present applicant group who did not finish high school would apply in the absence of a draft, while 24.6 per cent of the individuals with three to four years of college would still apply. A comparison of the quantity and mental quality of the applicant population expected in the absence of a draft with the Air Force's stated manpower quantity and quality requirements indicates that the Air Force will have difficulty meeting its requirements in the absence of a draft, especially in areas requiring higher mental aptitudes.

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## Chapter I - Introduction

The desirability of creating an all-volunteer armed force is currently a national issue. During the election campaign of 1968, President Richard M. Nixon pledged to eliminate the draft as a source of military manpower. Following a favorable report from a presidential commission chaired by former Secretary of Defense Thomas S. Gates, the Administration proposed an end to draft calls by 1973. This timetable may prove to be difficult to meet, however, since the chairmen of both the House and Senate Armed Services Committees have expressed reservations about the feasibility and desirability of relying solely on volunteers for military manpower.

Much of the controversy surrounding the all-volunteer force stems from uncertainty regarding the size of the military manpower deficit in the absence of a draft and the amount of additional incentives necessary to eliminate this deficit. The problem is basically one of determining the military manpower supply function. The approach to this problem taken by the Gates Commission, as described in Chapter II, was to determine the manpower deficit in the absence of a draft without additional incentives and then to determine the cost of eliminating this deficit using an estimated supply elasticity for military manpower.

**A. Factors Complicating the Estimation of Manpower Supply  
in the Absence of a Draft**

The problem of determining the number of individuals who would enlist in the absence of a draft is complicated by several factors. First, voluntary enlistments as well as inductions are affected by elimination of draft calls. Second, the manpower requirements of the armed forces and the supply of manpower are not homogeneous. Third, although detailed information is available for those individuals who actually enter military service, it is difficult to obtain information about the group of individuals who were potential candidates for entry into military service regardless of whether or not they actually were enlisted (that is, the total supply of available manpower).

**1. Effect on Voluntary Enlistment**

In addition to providing military manpower through direct inductions, the draft has powerful influence on the supply of volunteers for military service. A volunteer can choose the time he will enter service, and in many cases, choose a particular training program or an initial assignment, although volunteers must normally serve a

3.

longer term of service than draftees. Thus many individuals who would not voluntarily join the armed forces in the absence of a draft will perceive voluntary service as being a better alternative to being drafted. Any estimate of the number of volunteers available in the absence of a draft must consider the decrease in supply which would result from losing "draft-induced" volunteers as well as the loss of the inductees themselves. This can be accomplished only by estimating how the volunteer group would have behaved in the absence of the draft - a task difficult to perform with any objectivity, especially when limited to information available in most existing data systems.

2. Heterogeneous Supply

A lack of homogeneity in the supply of and the demand for military manpower also complicated the process of estimation. Individuals possessing different mental aptitudes, educational backgrounds, and physical characteristics are required as inputs to separate programs for officers, enlisted men and specialists (medical doctors, lawyers, chaplains). Furthermore, a considerable range of qualities may be required within each of these programs. For example,

4.

enlisted personnel are required by each of the military services to perform tasks ranging from highly skilled duties to menial jobs requiring no training and little mental aptitude.

On the supply side, the alternatives to military service an individual possesses in the absence of a draft are largely a function of his education and mental aptitude. Depending on their alternatives, individuals will react to the elimination of draft calls in different ways and will require varying amounts of additional compensation to induce them to enlist.

Both the supply of and the demand for military manpower are thus highly differentiated. Instead of merely determining a homogeneous military manpower supply function in the absence of the draft, the supply function in each differentiated quality subgroup of the population must be estimated and compared with military manpower requirements for that subgroup.

3. Data Availability

The supply of military manpower in the absence of a draft is a schedule indicating the number of individuals

who will volunteer for service at various levels of compensation. This includes all those who make themselves available for service, regardless of whether or not they are actually accepted. Little information exists concerning the group which actually applies for enlistment, although detailed data is available for those who are selected for entry. The selectee group is not a representative sample of the applicant population, however, especially in view of the quality differentiation which exists. The military services will attempt to select the highest quality individuals available, even though they exceed their minimum requirements. The selectee group will therefore consist of the highest quality individuals available in the applicant population, allowing for the fact that the selection process is chronologically and geographically disjoint. Conclusions concerning the selectee population and how it would respond to an elimination of the draft therefore do not indicate the changes which occur in the total supply of military manpower.

6.

B. Proposed Approach

This paper will demonstrate a means of overcoming these three above-mentioned areas of difficulty in determining the number and quality of Air Force enlisted volunteers in the absence of a draft at present compensation levels. The Air Force enlisted force during the past decade has depended exclusively on volunteers to meet its manpower requirements. However, due to a greater availability of technical training, better living conditions, and, since the beginning of the Viet Nam conflict, greater personal safety offered by the Air Force enlisted force relative to the Army, a large proportion of individuals faced with the possibility of being drafted see enlistment in the Air Force as a better alternative. These "draft-motivated" volunteers would not enlist in the absence of a draft.

Because tasks performed by the enlisted force include a large number of highly skilled technical specialties requiring high mental aptitudes, downward shifts in volunteer mental quality in the absence of a draft could create serious problems even though the number of volunteers meets Air Force needs.

Finally, no attempt has been made to organize a data base on applicants for enlistment, although detailed records are kept on selectees. The problem of determining the ability of the Air Force to meet its manpower needs in the absence of a draft thus provides an example of all three problems mentioned previously - defining and measuring changes in the "draft-induced" volunteer group, measuring shifts in the distribution of applicant quality and matching it against highly differentiated aptitude requirements, and finding a method of determining the nature of the applicant group.

Some previous studies have used survey results to determine the number of volunteers who enlisted to avoid being drafted. The surveys usually contain a question inquiring whether the individual would have enlisted in the absence of a draft. Direct inquiries such as this produce questionable results since many individuals who have already entered service will rationalize their decision as being for reasons other than draft avoidance. Surveys are also difficult to administer to enlistment applicants.

Recently, however, an alternative means of identifying draft-induced volunteers has become available. Before

1970, all individuals classified 1-A by the Selective Service System had an equal probability of being drafted. Since that time a lottery system has been used which provides individuals in the 1-A pool with varying probabilities of being drafted which range from virtual certainty of being drafted at one extreme to virtual exemption at the other depending on the individual's lottery number. A revealed preference model based on the number of volunteers holding each lottery number can be constructed and used to simulate reductions in draft calls to zero. This approach has limitations, since eighteen-year-olds are not included in the lottery draft pool and the pool for the first year (1970) differs significantly from subsequent years due to differing eligibility. The results are also valid only in the enlistment environment existing in 1970. However, no special surveys are required and the previously mentioned bias involved in survey results can be avoided.

The distribution of volunteers by lottery numbers can be used to predict changes in the size of quality subgroups as well as the overall supply of volunteers for Air Force enlistments. Air Force quality requirements are stated in terms of minimum Airman Qualifying Examination (AQE) scores. The AQE measures aptitude in four areas -

mechanical, administrative, general, and electrical. Each Air Force specialty has a "selector" AQE area and a minimum score in that area which all applicants must meet. For example, security police require an AQE general score of at least 40 for all entrants.

The lottery draft simulation model described above can be used to determine shifts in the distribution of AQE scores for each of the four AQE areas. Quality requirements in all four areas can be stated in terms of a single quality index which in turn can be compared with the distribution of individual mental aptitude available without a draft to determine if the number and quality of volunteers is sufficient to meet Air Force requirements. Throughout this paper, the distribution of mental aptitudes or enlistee "quality" stated as a requirement by the Air Force will be accepted as given.

The AQE is administered at USAF recruiting detachments to all individuals who apply for enlistment. Although no attempt is made to determine the distribution of scores for individuals who are not accepted for enlistments, all test sheets are stored in a document depository in San Antonio, Texas. Due to the difficulty in processing it and the lack of widespread knowledge of its existence,

this data has never been used in a study of this type. The test answer sheets contain birth date, AQE scores, an indication of whether or not an individual is applying for Air Force enlistment, sex, years of education, and the date the test was taken.

Since birth date is included, the lottery draft number for each applicant can be determined. Data obtained from these answer sheets can therefore be used as an input to the previously-mentioned revealed preference model, which predicts shifts in the quantity and quality of applicants for Air Force enlistment in the absence of a draft using the present distribution of lottery numbers. The specific population to be examined in this study consists of all applicants for enlistment between December, 1969 - the month in which the initial draft lottery was held - and October, 1970 - the latest month for which data is available. The AQE answer sheets are not machine readable and approximately 96,000 records are included in the subject population. A random sample will therefore be drawn for use in this study.

C. Chapter Outline

The basic study question of whether the quantity and quality of applicants for Air Force enlistment without the draft will meet Air Force requirements can be subdivided into three subsidiary questions. First, what is the nature of the relationship between the lottery numbers of applicants and quantity and quality of applicants? Second, how can the effect of draft elimination on applicant quantity and quality be measured? Third, will the applicants available without a draft fulfill the requirements of the Air Force? The following chapters will develop a means of answering these study questions.

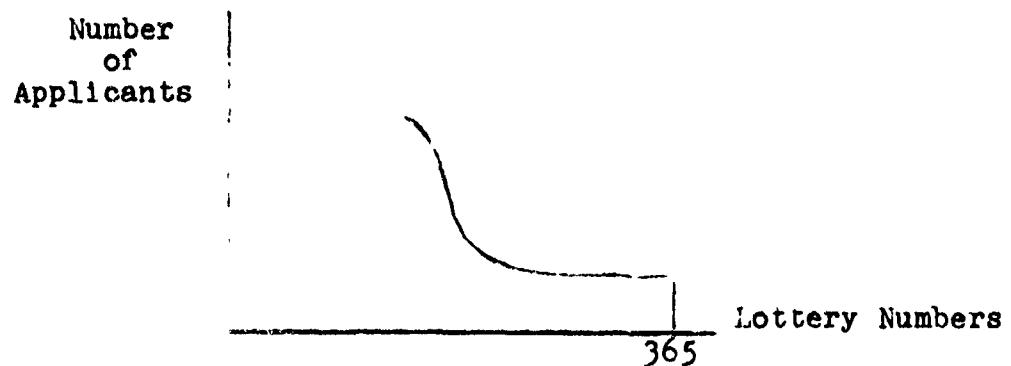
Chapter Two will review the relevant literature. Various approaches have been taken to the problem of estimating military manpower supply in the absence of a draft. It is worthwhile to discuss the advantages and disadvantages of some of them. This chapter also illustrates some of the deficiencies in former studies which currently exist that can be eliminated in this paper.

The nature of the relationship between lottery draft numbers and the distribution of applicants for Air Force enlistment serves as the basis for predicting the effects

of eliminating the draft. Chapter Three will examine the nature of this relationship. Since the individuals holding a particular lottery number are in effect a random sample from the total pool of available manpower, any variation in number of applicants can be attributed to a different perceived probability of being drafted. The primary relationship to be examined is the functional relationship between the number of applicants ( $Q_A$ ) and the applicants' lottery number ( $L$ ) where:

$$Q_A = f(L)$$

This relationship will be examined for the sample population and for subgroups within the population. The nature of the relationship is initially hypothesized to assume the following form:



The attractiveness of military service depends on

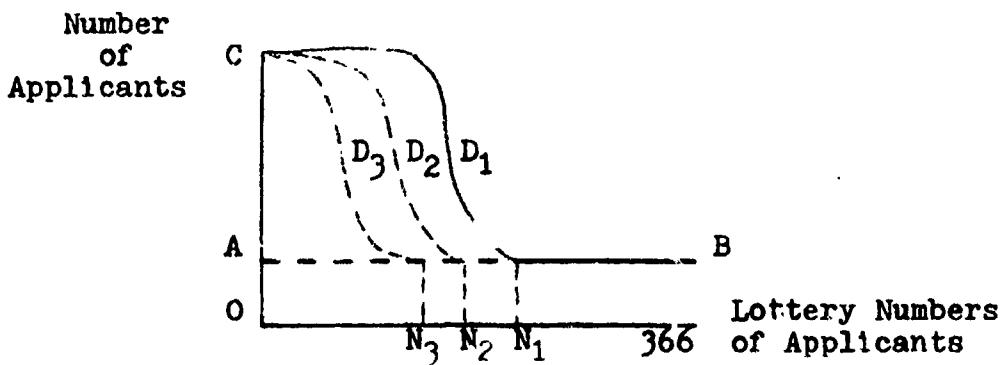
alternative opportunities in civilian life. A second hypothesis, to be examined in Chapter Four, is that individuals having superior aptitudes and educational backgrounds (and therefore above average civilian job opportunities) will volunteer at proportionately lower rates as draft calls decrease than those individuals having low aptitudes and limited educations:

$$\frac{dQ_A}{dD} = g(E, a), \text{ where } D = \text{draft call, } E = \text{educational level, } a = \text{aptitude level}$$

The relationships developed between number of applicants and lottery number, educational level, and aptitude will be used to create a model that will simulate the effect of decreasing draft calls on the quantity and quality of applicants for enlistment. Beginning with the relationship between lottery numbers and applicant quantity derived in Chapter Four for each quality subgroup in the population, the effect of decreasing draft calls can be simulated both in terms of the proportional decrease in numbers of applicants and shifts in the distribution of applicant quality.

For a given aptitude group, decreasing draft calls

can be simulated by determining the lottery number of the group which first shows the effects of draft pressure ( $N_1$ ):



As draft calls decrease from  $D_1$  to  $D_2$  to  $D_3$ , the applicant population decreases because individuals with lottery numbers in the middle of the range perceive a decrease in their probability of being drafted and apply for enlistment at lower rates. The point at which individuals perceive themselves as having a zero probability of being drafted shifts from  $N_1$  to  $N_3$ . However, until the draft is entirely eliminated, those individuals with the lowest lottery numbers are faced with an absolute certainty of being drafted.

In a zero-draft situation, the number of applicants from this subgroup would be estimated as the area under line AB. That is, all individuals would behave like those

who currently have lottery numbers high enough to insure that they will not be drafted (above  $N_1$ ). By simulating the effects of decreasing draft pressure to zero on each quality subgroup, the proportional decrease in the total number of applicants and changes in the relative size of each mental aptitude sub-group can be estimated.

Having determined the size of the applicant group and the distribution of aptitudes within the group, the ability of the Air Force to meet its enlisted manpower quantity and quality requirements in the absence of a draft and any change in incentives can be determined. Using the results of previous quality research, the predicted applicant quality distribution available in the absence of a draft will be restated in terms of a single quality index. Air Force quality requirements can likewise be stated in terms of the same index. Chapter Five will compare these two distributions as a means of determining the size of the manpower supply deficit without draft. It will also indicate the aptitude requirement areas which cannot be fulfilled when calls fall to zero. This provides information useful in determining the character of enlistment incentive programs or areas where aptitude requirement reductions through the use of in-

taisified training and job simplification programs should be considered. These and other implications of the study will be presented in the sixth and final chapter.

The data collection and data file creation process will be discussed in Appendix A. Unlike previous studies, this paper will use applicant data rather than information on individuals accepted for enlistment. By utilizing AAF examination sheets, a direct measure of enlistment applicants can be obtained. This section will also describe the Air Force's aptitude measures that will be utilized in this paper.

The approach taken in this study does have limitations. As previously stated, it is limited to applicants nineteen and older because it examines only those with lottery draft numbers. Also, a large portion of the individuals examined are from the 1970 pool, which was the transition year for the lottery system and in many ways not a typical group. The study takes Air Force aptitude requirements as given and assumes that the manpower allocation process in the Air Force approaches optimal efficiency. Findings will remain valid only if enlistment incentives and other factors influencing the 1970 enlistment group remain unchanged.

These limitations are counter-balanced by the three primary contributions of the study. First, it objectively treats the problem of determining the extent of draft motivated volunteers by using a perceived choice model. Second, it reflects the heterogeneous nature of the supply of and the demand for manpower in the Air Force enlisted force. Finally, it examines applicants for enlistment rather than the group being accepted under present conditions. In all of these areas, it represents an original approach to the problem of determining the quantity and quality of manpower available to the military in the absence of a draft.

## Chapter II - Previous Studies of Enlistments in a Zero-Draft Environment

Most previous studies of an all-volunteer force fall into one of two major categories. The first category consists of studies which examine the desirability of an all-volunteer force as a national policy. Most of these studies appeared in the late 1960's and culminated in the President's Commission on an All-Volunteer Force. Following the favorable recommendations of the Commission, the establishment of an all-volunteer military was adopted by the Nixon Administration as national policy.

The emphasis of most research concerning the all-volunteer force shifted at this point from an evaluation of the desirability of such a force to the second major category, a determination of the problems faced by the military services in the absence of a draft.

These problems had been considered in studies of the desirability of an all-volunteer force, since their magnitude and the cost of alleviating them were definitely factors bearing on the desirability of an all-volunteer force. However, the problems and their solutions were not treated in detail and usually were approached from the standpoint

of national manpower policy. The second group of studies takes the implementation of an all-volunteer force as given, with primary emphasis being placed on the manpower problems of the individual services and the specific policies required for their solution.<sup>1</sup>

The President's Commission of an All-Volunteer Armed Force included in its report an exhaustive examination of the manpower problems of the individual services. In his preface to the section on military manpower supply in a volume of studies prepared for the Commission, Harry J. Gilman described the process of analysis as one of: 1) determining military manpower needs in the absence of a draft, 2) finding the number of individuals who would be attracted to the military in the absence of a draft under current levels of incentives, and 3) estimating the type and magnitude of the relationship between military pay (relative to civilian income) and initial enlistments

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<sup>1</sup> The best bibliographical source covering both of these categories is G.L. Brunner and A.A. Cook, Jr. Published Research Concerning Military Enlistment and a Volunteer Military, WN-7295-PR. Santa Monica: The Rand Corporation, 1971. Major articles in category one are: Walter Y. Oi, "The Economic Cost of the Draft," The American Economic Review, LVII, No.2 (May, 1967), p.39-62; and A.C. Fisher, "The Cost of the Draft and the Cost of Ending the Draft," American Economic Review, LIX, No.3 (June, 1969), 237-254.

and re-enlistments.<sup>2</sup> These three questions are interrelated to some degree, since the manpower requirements of the services will be influenced by the cost of attracting volunteers without a draft. In this paper, however, the Air Force's current quantity and quality requirements will be assumed to remain unchanged. The primary emphasis will be placed on obtaining an answer to the second problem posed by Gilman - estimating the quantity (and quality) of individuals who would enlist with present incentives in the absence of a draft. A comparison of the requirements for Air Force manpower with the estimated supply of manpower will provide insight into the nature of the additional incentives necessary to match supply with requirements.

Since the primary question to be explored concerns the number of Air Force volunteers in the absence of a draft under present conditions, this chapter consists primarily of a review of alternative approaches presently being used to examine this problem. However, to place

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<sup>2</sup>Harry J. Gilman, "The Supply of Volunteers to the Military Services," in Studies Prepared for the President's Commission on an All-Volunteer Armed Force, Washington, D.C.: Government Printing Office (November, 1970), p.II-1-2.

these alternative approaches in context, the present theoretical treatment of the military enlistment process will first be explored.

#### A. Theoretical Basis for Military Enlistment

The usual theoretical treatment of military enlistment found in the literature makes use of the standard economic model of occupational choice.<sup>3</sup> Military enlistment is envisioned as one of several possible employment alternatives open to an individual at a given point in time. Each alternative provides him with a particular level of monetary income and a positive or negative non-

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<sup>3</sup>A development of the theoretical model described here can be found in: Stuart H. Altman, "Earnings, Unemployment, and the Supply of Enlisted Volunteers," Journal of Human Resources, Vol. IV, No.1 (Winter, 1969), P.210; Alan E. Fechter, Influence of Pay and Draft Policies on Army Enlistments: A Time-Series Analysis. Arlington, Virginia: Institute for Defense Analysis, 1970, p.3; and Alvin A. Cook, Jr., The Supply of Air Force Volunteers, RM-6361-PR. Santa Monica: The Rand Corporation (September, 1970), p.II-4-2; and Anthony C. Fisher, "The Cost of the Draft and the Cost of Ending ....The model developed in all four papers is largely the same. The particular notation adopted through the rest of this section is from Fechter.

monetary or "psychic" income. An individual is assumed to be able to state his non-monetary income in monetary terms.

In the case of the military, monetary income is in the form of military pay and allowances. Positive non-monetary benefits can take the form of opportunity for training, security, military life style, travel, and satisfaction from having served the nation. Negative non-monetary benefits include increased restrictions on personal conduct, inability to control work assignment or location, possible personal risk resulting from combat, and commitment for the term of enlistment. The monetary benefits of military service are thus positive for all individuals while non-monetary benefits may be positive or negative depending on an individual's personal preferences, as they are for other job opportunities.

In a situation where there is no draft, a rational individual will evaluate military service in a manner similar to his other employment alternatives. "We can postulate that the potential enlistee can determine a reservation military wage,  $M_1^*$ , that would make the sum of the pecuniary and non-pecuniary benefits from choosing enlistment activity just equal to the sum of the pecuniary

and non-pecuniary benefits of choosing non-enlistment activity.<sup>4</sup> Thus if the actual military wage ( $M_1$ ) offered exceeded  $M_1^*$ , the individual would enlist. If not, he would not enlist.  $M_1^*$  can also be stated in terms of the monetary value of an individual's next best alternative to military service,  $C_1$ :

$$M_1^* = (1-d_1)C_1 \quad (1)$$

where  $d_1$  is an index of the individual's net preference for military service. A negative  $d_1$  indicates that an individual perceives the non-monetary benefits of alternative employment to be higher than the non-monetary benefits of military service. In this case,  $M_1$  would have to exceed  $C_1$  to induce enlistment. In the absence of a draft, reservation military wage is therefore seen as dependent on an individual's net taste for military service ( $d_1$ ).

Given the distribution of  $C_1$ 's and  $d_1$ 's within the population of potential enlistees, it is possible to construct the distribution of military reservation wages within the military. (fig.1) At any given level of military pay,

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<sup>4</sup>Fechter, p.4.

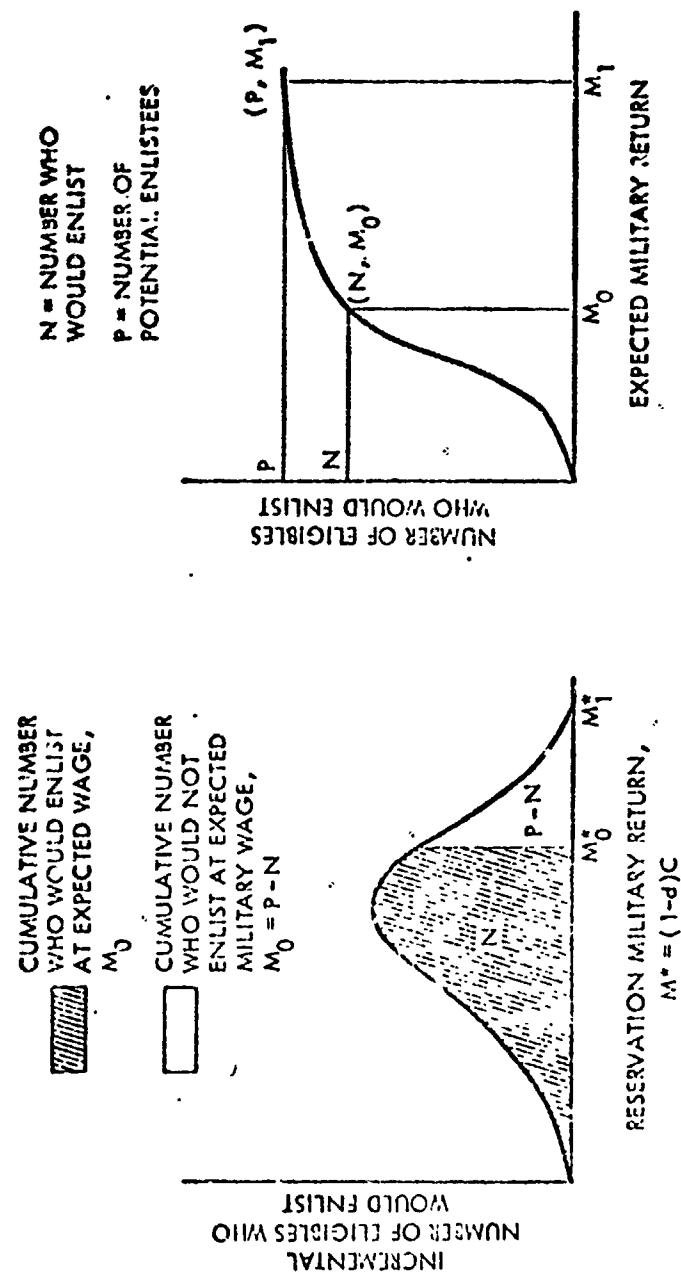


Fig. 1 -- The Distribution of Military Reserve Wages in the Population of Individuals Eligible for Military Service and the Supply Schedule for Military Manpower.

Source: Alan E. Fechter, p.6.

$M_0$ , the number of individuals who would enlist is equal to the shaded area to the left of  $M_0^*$  (that is, all individuals for whom  $M_0 \geq M_0^*$ ). The cumulative frequency distribution derived from this distribution is the enlistment supply schedule shown in figure 1. This schedule shows the number of enlistments that would take place at a given level of military pay, all other things being held constant. The supply function may be defined as:

$$N = g(M, C, d, P) \quad (2)$$

where  $N$  = number of enlistees

$M$  = monetary return from military service

$C$  = monetary return from non-military activity

$d$  = net non-monetary benefit derived from military service

$P$  = population of potential enlistees

An increase in any of the above independent variables, except  $C$ , can be expected to increase  $N$ . An increase in civilian monetary income ( $C$ ) will decrease enlistment rates.

The above equation is the traditional model of occupational choice as it would be applied to representation of an enlistment supply function in a world in which there is no draft. The existence of the draft, however, modifies the situation faced by the rational individual assumed in this model and requires that the model be modified to reflect the changed situation. In an environment where

the draft exists, an individual choosing not to enter the military is faced with some probability of being drafted. It is possible to follow a civilian pursuit which provides exemption from the draft, but recent changes in exemption policy have made this alternative largely unworkable.<sup>5</sup> For the purposes of this model, all potential enlistees are assumed to be available for induction.

Fechter identifies two ways in which the presence of the draft affects an individual's monetary returns. "First, if the potential enlistee is inducted, then, over the period of induction,  $C_1 = M_1$ . Second, the potential enlistee is not certain that he will be inducted."<sup>6</sup> Each individual perceives a probability of being drafted,  $p_1$ . In the presence of a draft, the expected monetary benefit

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<sup>5</sup> A detailed, although currently outdated, examination of the enlistment decision is contained in: David F. Bradford, "A Model of the Enlistment Decision Under Draft Uncertainty," Quarterly Journal of Economics, LXXXII, No.4 (November, 1968), 621-638. Bradford examines the optimal strategy for the utility-maximizing individual under the old draft system. The lottery system, the elimination of occupational deferments, and the deletion of the policy requiring local boards to take the "oldest first" have diminished the relevance of most of his findings.

<sup>6</sup> Fechter, p.7.

resulting from the decision not to enlist is the sum of the expected monetary returns from military service in the event the individual is drafted ( $p_1 M_1$ ) and the expected monetary returns from civilian employment  $\left[ (1-p_1) C_1' \right]$ :

$$C_1 = p_1 M_1 + (1-p_1) C_1' \quad (3)$$

$C_1'$  is the expected monetary return from civilian employment given that the individual is not drafted. The final form of the supply function described in (2) thus becomes:

$$E = e(M, C, p, d, P) \quad (4)$$

Like the other previously-mentioned theoretical models of draft-motivated enlistments, Fechter's model does not adequately explain the effect of changing draft pressure on enlistments. The deficiency of the model can best be illustrated by substituting (3) into (1) yielding:

$$M_1^* = (1-d_1) \left[ p_1 M_1 + (1-p_1) C_1' \right] \quad (5)$$

As the probability of being drafted approaches certainty, the expected monetary benefits of not enlisting approach

the monetary benefits of enlistment,  $M_1$ . Similarly, the non-monetary benefits of not enlisting approach the non-monetary benefits of enlistment, implying that  $d_1$  goes to zero:

As  $p_1 \rightarrow 1$ ,  $C_1 = p_1 M_1 + (1-p_1) C_1' \rightarrow M_1$  and  $d_1 \rightarrow 0$ .

Then, since  $M_1^* = (1-d_1) C_1$ , as  $p_1 \rightarrow 1$ ,  $M_1^* \rightarrow M_1$

For any individual, the decision to enlist is based on the current level of military pay,  $M_1$ , and his reservation wage,  $M_1^*$ . If  $M_1 > M_1^*$ , he will enlist. Otherwise, he will not. If a change in probability of being drafted is to affect the supply of enlistments as hypothesized, the direction of the inequality between  $M_1$  and  $M_1^*$  must change as  $p_1$  changes for some potential enlists.

However, as indicated above,  $M_1^*$  approaches  $M_1$  as a limit for each individual as  $p$  approaches one, so if  $M_1^*$  is above  $M_1$  at any value of  $p_1$  ( $0 < p_1 < 1$ ), it will be above  $M_1$  for all values. Likewise, if  $M_1^*$  is below  $M_1$  at any value of  $p_1$ , it will be below  $M_1$  for all values of  $p_1$ . A change in  $p_1$  therefore cannot reverse the direction of the inequality  $M_1 > M_1^*$  or  $M_1 < M_1^*$ , which implies that in Fechter's model the probability of being drafted,  $p_1$ , has

no effect on the number of individuals who will enlist. The model thus fails to illustrate any relationship between draft pressure and enlistment rates.<sup>7</sup>

This result follows logically from Fechter's assumptions, and the assumptions of those who have constructed similar models. "Military service" is seen as a homogeneous state, with equal monetary and non-monetary benefits resulting from enlistment and induction. Under these conditions, a rational individual who chooses not to enlist in the absence of a draft ( $M_1^* > M_1$ ) would choose not to enlist so long as there was the slightest chance of escaping induction. ( $M_1^* > M_1$ , for  $0 < p_1 < 1$ ). If induction was a certainty, the individual would be indifferent between induction or enlistment ( $M_1^* = M_1$ , for  $p_1 = 1$ ).

Assuming that only enlisted service is considered, monetary benefits,  $M_1$ , are equal for both enlistees or inductees. However, as described in Chapter I, enlistees receive additional non-monetary benefits in the form of training, improved living conditions, and decreased combat

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<sup>7</sup> Fechter recognizes this difficulty with his model (and attempts to correct it by hypothesizing that  $d_1$  will increase as  $p_1$  increases). While this will correct the model's deficiency, it is difficult to see why an increase in  $p_1$  will produce an increase in the "net taste" for military service.

risk. An individual who decides not to enlist thus incurs an opportunity cost in the form of decreased non-monetary benefits if he is inducted. Using the notational system previously adopted, this opportunity cost can be expressed as  $p_1 e_1 M_1$ , where  $e_1$  is an index of the individual's net preference for enlistee status over inductee status in terms of military benefits. A positive  $e_1$  indicates that the non-monetary benefits of enlistment are perceived as exceeding the non-monetary benefits of induction. Opportunity cost ( $e_1 M_1$ ) is multiplied by  $p_1$  because the cost is incurred only if the individual is inducted. Including the opportunity cost of non-enlistment in equation (3) results in:

$$\begin{aligned} C_1 &= p_1 M_1 + (1-p_1) C_1' - p_1 e_1 M_1 \\ &= p_1 (1-e_1) M_1 + (1-p_1) C_1' \end{aligned} \quad (6)$$

substituting (6) into (1) yields:

$$M_1^* = (1-d_1) \left[ p_1 (1-e_1) M_1 + (1-p_1) C_1' \right] \quad (7)$$

For this equation as  $p_1 \rightarrow 1$ ,  $M_1^* \rightarrow (1-e_1) M_1$ ; when  $p_1=1$  and  $e_1 > 0$ ,  $M_1 > M_1^*$ . This implies that all potential enlistees

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with a net non-monetary preference for enlistment over induction will choose to enlist at some level of  $p_1$  less than one. It also implies that as  $p_1$  increases, an individual's civilian alternatives ( $C_1'$ ) become less important in shaping his enlistment decision, while his net non-monetary preference for enlistment over induction ( $e_1$ ) plays a larger role. The model thus appears to explain the effect of changes in  $p_1$  on enlistments. The supply function resulting from this equation is:

$$E = g(M, C, p, d, P)$$

where the nature of the hypothesized relationship between  $E$  and each independent variable is as follows:

$$\frac{\partial E}{\partial M} > 0 \quad \frac{\partial E}{\partial C} < 0 \quad \frac{\partial E}{\partial p} > 0$$

$$\frac{\partial E}{\partial e} > 0 \quad \frac{\partial E}{\partial d} > 0 \quad \frac{\partial E}{\partial P} > 0$$

In the studies to be examined in the remaining sections of this paper, three different approaches to the estimation of  $E$  when  $p$  is reduced to zero are considered. The next section will consider studies using multiple regression

analysis to estimate the sensitivity of enlistment rates to changes in the independent variables described above. The following section contains the results of surveys conducted to determine the number of enlistees in a zero-draft environment, and the final section examines a group of studies based on draft lottery numbers within the enlisted population. The primary objectives in this review of the literature will be to determine the currently estimated quantity and quality of enlistees in the absence of a draft, to compare these estimates with the a priori expectations resulting from the theoretical model developed in this section, and to examine the limitations of existing work in this area. Studies of Air Force enlistment are used whenever possible, although analyses of other services are presented when they illustrate an approach not used in examining Air Force enlistments.

#### B. Studies Based on Observations of Enlistment Behavior

The effects of draft pressure, military pay, and other causal factors on enlistments can be determined by observ-

ing the effects that changes in these factors have had on past enlistments. Multiple regression of either time series or cross sectional data can be used to estimate the number of individuals who would enlist in the absence of a draft and the increase in military pay (relative to civilian pay) necessary to meet military manpower requirements. This type of analysis can therefore be used to satisfy both the second (estimation of the number of enlistees under present conditions without a draft) and the third (estimation of the cost of removing any manpower deficit existing without a draft) problems posed by Gilman, in his approach to estimating the cost of an all-volunteer force, as described in the introduction to this chapter. This type of study, since it is based on observations of past data, will be referred to as the observation method.

The approach used in the observation method consists of formulating an estimating equation expressing a hypothesized relationship between enlistments or enlistment rate and a number of independent variables. Using regression analysis, the sensitivity of enlistments to changes in each of the independent variables can be expressed in terms of elasticities, which indicate the percentage change in enlistments associated with a percentage change

in the independent variable. These elasticities can then be used to project the results of policy actions such as reducing the draft to zero or increasing military pay.

Since the observation method provides information about both draft pressure and the effects of pay increases, it has been undertaken by many of the individuals doing work in this area. Due to the large number of studies of this type that have been produced and the high level of complexity in many of them, an exhaustive examination of each study will not be attempted. Primary attention will be given to the estimating equation adopted in each study as compared to the theoretical model of enlistment behavior previously developed and to the results produced by the study, particularly if they include an estimate of enlistees available without a draft. The advantages and limitations of each study will also be noted and a general critique of the observation method as a means of measuring the effect of draft pressure on enlistments will be given at the end of the section.

Studies of this type can be classified into two major subcategories - those using time-series data and those using cross-sectional data. Only those using time-series data will be examined, since cross-sectional data

is not adaptable to investigating the effect of draft pressure on enlistments.<sup>8</sup>

#### 1. Altman and Fechter

The simplest estimating equation used with time-series data appears in Altman and Fechter.<sup>9</sup> Rather than estimating

<sup>8</sup> Cross-sectional data has not been used to examine the effect of draft pressure on enlistments because variations in draft pressure on population sub-groups at a given moment cannot be measured. Before the lottery was instituted, the Selective Service System attempted to randomly select inductees from the pool of available 1-A's. At the present time, the only characteristic which can be used to measure individual differences in probability of being drafted is the individual's lottery draft number. Studies using cross-sectional data have all used survey data to estimate the decrease in enlistments resulting from draft elimination. Cross-sectional data was used only to estimate the sensitivity of enlistments to differences in unemployment rate, relative military pay and other independent variables which did not include probability of being drafted. Studies using cross-sectional data include: Walter Y. Oi, op. cit., Stuart H. Altman, "Earnings..." op. cit., and Burton C. Gray, "Supply of First Term Military Enlistees: A Cross-Section Analysis," in Studies Prepared for the President's Commission on an All-Volunteer Force..., pp.II-2-1 - II-2-40.

<sup>9</sup>Stuart H. Altman and Alan E. Fechter, "The Supply of Military Personnel in the Absence of a Draft," American Economic Review, LVII, No.2 (May, 1967), p.19.

the level of enlistments without a draft directly, Altman and Fechter use the observation method to arrive at an estimate of enlistments in the 1970-75 time period assuming a low level of draft calls and various levels of civilian unemployment. They then multiply this estimate by the percentage of individuals they estimate would have enlisted in the absence of a draft (from the 1964 Department of Defense Survey discussed in the following section) to obtain the estimated enlistments for the 1970-75 period in the absence of a draft.

Since all factors influencing enlistments are assumed to remain unchanged aside from draft pressure and unemployment level, Altman and Fechter's estimating equation assumes a relatively simple form:<sup>10</sup>

$$\frac{E}{P} = .03018 + .3567OU^{**} + .02007D_H^* - .01341D_I - .01024S_p + .02107S_u^{**} - .00517F$$

$$(.07696) \quad (.00865) \quad (.00703)$$

$$(.00522) \quad (.00620) \quad (.00588)$$

Numbers in parentheses indicate standard error values.

\*\*Significant at .01 level; \*Significant at .05 level

where,  $\frac{E}{P}$  = quarterly Army Mental Group I-III enlistments divided by the 18-19 year old male population

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<sup>10</sup>Ibid., p.20.

$U$  = the 18-19 year old male unemployment rate

$D_H$  = a dummy variable for periods of high draft pressure (the four quarters during the Berlin build-up crisis)

$D_L$  = a dummy variable for periods of low draft pressure (the four quarters of FY 1965 during which time draft calls were low and there was extensive publicity about the long-run possibility of eliminating the draft)

$S_p$  = a spring seasonal dummy variable

$S_u$  = a summer seasonal dummy variable

$F$  = a fall seasonal dummy variable

Using quarterly data from July, 1956 - June, 1965, Altman and Fechter developed  $b_1$ 's which supported the following conclusions:

(1) periods of relatively high civilian employment tended to produce greater than average numbers of volunteers; (2) periods of relatively high "draft pressure" (increased world tensions) also produced higher than average levels of volunteers, while periods of low "draft pressure" produced less than average enlistments; (3) enlistments were above average in the quarter just following high school graduation and below average in the fall and spring.<sup>11</sup>

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<sup>11</sup> Ibid., p.20.

In terms of the variables introduced in the theoretical model (eq.7), variations in unemployment corresponds to changes in expected income ( $C_1'$ ), changes in draft pressure or changes in probability of being drafted ( $p_1$ ) and seasonal variations can be explained in terms of variations in the group available for enlistment. The direction of change in enlistments observed by Altman and Fechter is consistent with the a priori predictions of the theoretical model.

## 2. Fisher

Fisher develops a somewhat more complex estimating equation in his study of enlistments in a zero-draft environment.<sup>12</sup> Unlike Altman and Fechter, Fisher estimates the enlistment rate (A&F's E/P) without a draft directly from the coefficients derived from regression of time series data. The functional relationship hypothesized by Fisher is basically the same as in the theoret-

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<sup>12</sup>A.C. Fisher, "The Cost of the Draft...,p.239.

ical model developed by Fechter, as described in the preceding section. Using the notation introduced in the 1st section, Fisher's "reserve wage" ( $M_1^*$ ) in the presence of a draft is expressed in the same manner as Fechter's.<sup>13</sup>

$$M_1^* = (1+d) \left[ p_1 M_1 + (1-p_1) C_1' \right]$$

Fisher's  $C_1' = (1-U)C_1''$  where  $C_1''$  is the expected civilian wage if employed and  $U$  is the unemployment rate. Fisher's estimating equation thus becomes:

$$E/P = g(M, C'', U, p)$$

His estimating equation is therefore open to the same criticism as Fechter's model in the preceding section.

Fisher's equation is unique in that he defines  $p$ , the probability of being drafted (or level of "draft pressure" as Altman and Fechter refer to it) as total accessions over the population of potential enlistees rather than inductions over potential enlistee population. Fisher uses total accessions rather than inductions alone

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<sup>13</sup>This result can be obtained by substituting Fisher's expected civilian wage with a draft (A.C. Fisher, "The Cost of the Draft..., p.245) into his expression for the equivalent military wage (A.C. Fisher, "The Cost of the Draft..., p.241).

because of the complex inter-relationship between inductions and enlistments. A high level of inductions increases the probability of being drafted and thus, according to the theoretical model, induces additional individuals to enlist. However, since the level of inductions is the difference between the military's requirement for manpower and voluntary enlistments, a rise in enlistments will reduce the level of inductions necessary to meet requirements. If enlistments increase over time due to improvements in military pay or conditions of service, the result will be a lower induction rate and decreased "draft pressure." "Thus, enlistments could be spacially negatively related to inductions . . . Any coefficient obtained to measure the relationship between inductions and enlistments is likely then to be an underestimate of that relationship."<sup>14</sup>

The interrelationship existing between inductions and enlistments is a major problem that must be overcome in any study which attempts to determine the effect of draft pressure on enlistments. Fisher's study is the only one examined which recognizes this problem and has attempted

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<sup>14</sup>A.C. Fisher, "The Cos of the Draft..., p.245.

overcome it. However, his substitution of total enlistments for inductions as a measure of draft pressure is not wholly satisfactory, in that he measures it solely in terms of probability of having to enter service. In the theoretical model, "draft pressure" is measured by the term  $p_1 e_1 M_1$  (the opportunity cost of choosing not to enlist). While changes in  $p_1$  can produce changes in draft pressure, factors which influence  $e_1$ , the net preference for enlistment over induction, also can produce changes in draft pressure and the resulting fluctuations in the enlistment rate. The study by Fechter, which will be considered next, does include a measure of  $e_1$ .

Fisher determines the enlistments available in a zero-draft environment under present conditions by determining the enlistment rate (E/P) projected by his model if all accessions were received through voluntary enlistment. Quarterly data for FY 1958-65 were used. He then determines the enlistment rate necessary to meet military manpower requirements and calculates the percentage increase in the expected rate necessary to fulfill requirements. Fisher estimates a 24% deficit in enlistments at present pay levels without a draft.<sup>15</sup>

<sup>15</sup>Ibid., p.250.

## 3. Fechter

The estimating equation developed by Fechter in his study of Army enlistments is the most complex relationship examined. Fechter's estimating equation is:<sup>16</sup>

$$e_t = a_0 + a_1 R_t + a_2 EMP_t + a_3 DP_t + a_4 CAS_t + a_5 D-BERL_t + a_6 D-CUBA + a_7 D-II_t + a_8 D-III_t + a_9 D-IV_t + U_t$$

where  $e_t$  = enlistment rate of white males in Mental Groups I-III

$R_t$  = Military pay divided by civilian pay

$EMP_t$  = employment rate, white males, 16-19 years old

$DP_t$  = induction rate (inductees divided by male population, age 17-24)

$CAS_t$  = number of casualties in Southeast Asia

$D-BERL_t$  = dummy variable signifying the period of the Berlin crisis

$D-CUBA_t$  = dummy variable signifying the period of the Cuban missile crisis

$D-II_t$ ,  $D-III_t$ ,  $D-IV_t$  = dummy variables for the second, third and fourth quarter of the calendar year

$U_t$  = error term

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<sup>16</sup> Alan E. Fechter, Influence of Pay..., p.9.

The  $a_1$ 's are determined by regression of quarterly data for calendar 1958 through 1968. Fechter develops several alternative models based on varied assumptions about the time it takes for a change in an independent variable to affect enlistments, the existence of an "income effect" from offsetting raises in military and civilian pay, and the existence of interaction between independent variables (the latter being used primarily to test the stability of the  $a_1$ 's). His empirical results are thus too voluminous for presentation here.

Viewed from the standpoint of the theoretical model developed by Fechter (eq.1), the Southeast Asia casualties variable is seen as a measure of increased non-monetary cost of military service.<sup>17</sup> As casualties increase,  $d_1$  and  $M_1^*$  could both be expected to increase. Based on Fechter's model, an increase in casualties should decrease enlistments. Under the alternative theoretical model, (eq.7),  $d_1$  would also increase. However, since draftees are more likely to be assigned to combat arms, increased combat casualties could be expected to increase  $e_1$ , the net preference for enlistment over induction. Thus, under

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<sup>17</sup>Ibid., p.10.

eq.7 the effects of increased casualties could have a positive or negative effect on enlistments, depending on the relative size of  $\Delta e$  and  $\Delta d$ . Fechter found that "the net effect of casualties on enlistment rates estimated from the interaction equations turns out to be positive, but very small."<sup>18</sup> This result is therefore inconsistent with Fechter's theoretical model, but not with the alternative model developed in this paper.

The elasticity of enlistments with respect to changes in induction rates proved to be extremely unstable in Fechter's model, both with respect to the use of lagged variables and the introduction of interaction terms. Elasticities were found ranging from .10 to .68. Also, the method of estimating probability of being drafted appears to be "one of the major factors" contributing to the serial correlation which exists in the residuals of the static equations.<sup>19</sup> Fechter notes that the effect of induction rate on enlistments is "unusually small."<sup>20</sup> As indicated

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<sup>18</sup> Ibid., p.27.

<sup>19</sup> Ibid., p.38.

<sup>20</sup> Ibid., p.38.

in the discussion of the Fisher article, using the induction rate as a measure of draft pressure will probably result in an understatement of the effect of draft pressure on enlistments, which may explain the result obtained by Fechter.

#### 4. Cook, and Cook and White

The final articles dealing with the regression of time-series data to determine the proportion of volunteers in absence of a draft are of special interest in the context of this paper because they examine Air Force enlistments, particularly the problem of determining aptitude level in an all-volunteer force. Both of the two studies to be examined utilize basically the same model and data base. The first, by Alvin A. Cook, considers the more general problem of estimating the supply of volunteers in the absence of a draft.<sup>21</sup> The second study, by Cook and White, is specifically concerned with the quality of

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<sup>21</sup>Alvin A. Cook, Jr., The Supply..., p.1.

volunteers available without a draft.<sup>22</sup>

The basic model used in both of these studies begins with the basic model used by Fechter for enlistments in the absence of a draft. Once again, Fechter's notation is used. Enlistment will take place when the military wage ( $M_1$ ) exceeds the military reserve wage ( $M_1^*$ ):<sup>23</sup>

$M_1 \geq M_1^*$ , where

$$M_1^* = (1+d_1)C_1 \quad (1)$$

As the military wage increases in relation to the civilian wage, individuals with larger  $d_1$ 's will be induced to enlist. The result is that at each level of  $M/C$ , a specific number of individuals will apply for Air Force enlistment. The locus of these points is the Air Force's supply curve.

In the case of the Army examined by Fechter, enlistments must be supplemented by inductees to fulfill manpower requirements. The number of enlistees thus always equals

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<sup>22</sup>Alvin A. Cook, Jr., and John P. White, Estimating the Quality of Air Force Volunteers, RM-63608-PR. Santa Monica: The Rand Corporation (September, 1970).

<sup>23</sup>Alvin A. Cook, Jr., The Supply..., p.7.

the number of qualified applicants for enlistment. However, the Air Force is usually capable of fulfilling its manpower requirements with enlistees alone, indicating that the number of qualified individuals applying for enlistment usually exceeds the Air Force's manpower requirements, which are determined by strength and budgetary authorizations.

The model used by Cook, and Cook and White, assumes that the Air Force equalizes applicant supply with its requirements by selecting the individuals with higher aptitudes from the applicant group. The distribution of applicant quality, as measured by percentile score on the Armed Forces Qualifying Test (AFQT), is given the distribution  $f(q)$ . Only individuals with a percentile score above 24 are acceptable for enlistment, so Cook and White represent the total number of qualified applicants for enlistment as:<sup>24</sup>

$$Y = \int_{24}^{100} f(q) dq$$

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<sup>24</sup>Ibid., p.9.

If  $Y$  exceeds the Air Force's manpower requirements ( $R$ ), the Air Force will select the best  $R$  applicants available. The lowest percentile score actually accepted becomes  $q_0$ , where:

$$R = \int_{q_0}^{100} f(q) dq$$

The relationship between  $q_0$  and the cut-off point (24th percentile) for the population is illustrated in fig. 2.

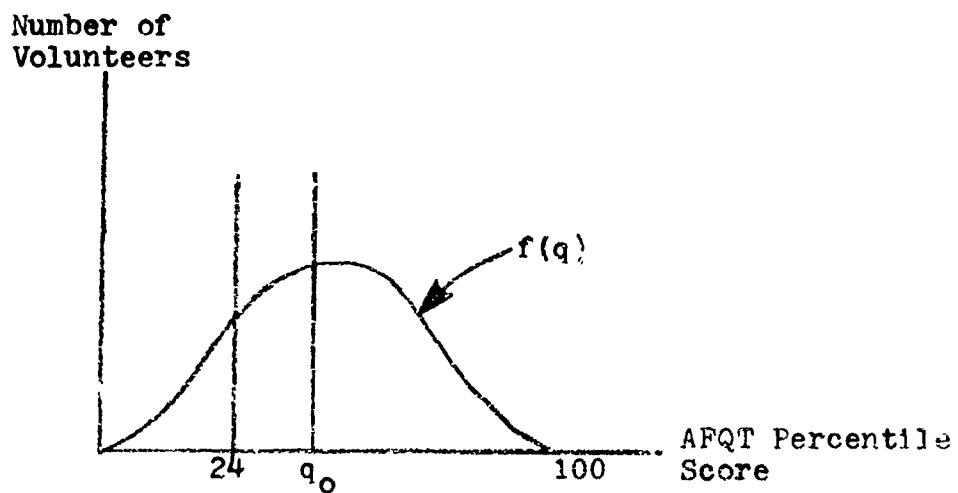


Fig. 2. Distribution of Volunteers by Quality  
from Alvin A. Cook, Jr., The Supply..., p.9.

The quality distribution,  $f(q)$ , is assumed to shift upward or down with changes in relative military pay (E), unemployment (U), and draft pressure (D). The effects of these parameters on Y can be expressed as:

$$Y = \int_{24}^{100} W(E, D, U) f(q) dq$$

where  $W(E, D, U)$  is a function that shifts  $f(q)$ .  $Q_A$ , the average enlistee quality level, is inversely related to the supply of available enlistments. As illustrated in fig. 2, the quality of enlistees increases as the proportion of the applicant population accepted for enlistment decreases. Therefore, the enlistee population must be adjusted for changes in quality,  $Q_A$ , if it is to reflect changes in the underlying applicant population (Y). The final estimating equation used by Cook to estimate quantity shifts is:<sup>25</sup>

$$Y_A = X E^a D^b U^c Q_A^r$$

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<sup>25</sup>Ibid., p.14.

where  $Y_A$  is the number of acceptable volunteers.

Cook and White use the model developed above to examine changes in quality level. Average enlistee quality can be stated in terms of  $f(q)$  and  $h(E,D,U,P)$ , which represents the relationship between  $f(q)$  and relative military pay, draft pressure, unemployment, and the size of the eligible population; such that:

$$Q = \int_{q_0}^{100} qh(E,D,U,P)f(q)dq$$

where  $q_0$  will allow the enlistment requirement (R) to be met.<sup>26</sup> Therefore:

$$Q = t(E,D,U,P,R)$$

Cook and White selected a form for the estimating equation such that the elasticity of quality (percentage change in average mental aptitude, Q, produced by a one percent change in one of the independent variables affecting Q)

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<sup>26</sup>Alvin A. Cook, Jr., and John P. White, Estimating the Quality..., p.13.

with respect to each argument would decrease "for relatively large values of quality."<sup>27</sup>

$$Q/100 = 1 - XE^a D_1^b D_2^c U^d R^e p^f$$

$D_1$  and  $D_2$  in the above equation represent the two measures of draft pressure used in both of these studies.  $D_1$  is the number of inductees over the pool of individuals who have received pre-induction physicals and were found fit for military service (the most draft-vulnerable group).  $D_2$  represents the group who have been called to take pre-induction physicals as a proportion of the total 1-A pool. Since both  $D_1$  and  $D_2$  are based on the level of inductions, the estimates of their effect on quantity and quality are probably biased downward, for reasons developed in the discussion of the Fisher article.

In both studies, quarterly observations from the first quarter of 1959 through the second quarter of 1967 are used. In both studies, only the second measure of draft pressure,  $D_2$ , yielded significant results. However, the effects of changes in  $D_2$  were minor when compared to

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<sup>27</sup>Ibid., p.14.

the effects of changes in relative military pay on enlissee quantity<sup>28</sup> and quality.<sup>29</sup> Also, high quality individuals were found to be less responsive to changes in D<sub>2</sub> than other quality groups and more responsive to pay changes. Taken together, these results imply that elimination of the draft would have a relatively minor effect on enlistments, that enlistments would be very responsive to an offsetting pay increase, and that the resulting force would be of higher quality than the previous applicant group, both because high quality people would drop out of the applicant group at a slower rate as draft pressure subsides and because they would be more responsive to an offsetting pay increase.

As previously stated, D<sub>1</sub> and D<sub>2</sub> probably underestimate the effects of draft pressure on quantity and quality. However, Cook and White's model is open to question on the more basic grounds that it does not accurately reflect the recruiting process. Both studies are based on the assumption that the Air Force, and specifically Air

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<sup>28</sup> Alvin A. Cook, Jr., The Supply..., p.31.

<sup>29</sup> Alvin A. Cook, Jr., and John P. White, Estimating the Quality..., p.21.

Force recruiters, "cream" the applicant population by selecting the better applicants over less qualified applicants. Cook qualifies the "creaming" assumption somewhat by stating that "in terms of the stochastic arrival of volunteers to the many recruiting centers, USAF recruiters undoubtedly accept less qualified men in the face of uncertain arrival of more qualified men" but concludes that "recruiters naturally prefer better applicants to poorer ones."<sup>30</sup> Individuals who have worked as Air Force recruiters dispute this, contending that the quota system used in recruiting provides no incentive to maximize quality. Rather, the recruiter will accept the first qualified applicants for enlistment.<sup>31</sup>

If the "creaming" process described by Cook and White is, at best, highly imperfect, an alternative hypothesis must be offered to explain the "emphatically negative" relationship found by the authors between the accessions

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<sup>30</sup> Alvin A. Cook, Jr., The Supply.... p.8.

<sup>31</sup> Interview, author with CMSgt L.W. May, Hq USAF Recruiting Service, Randolph AFB, Texas, May 8, 1971.

variable and quality.<sup>32</sup> As explained earlier, Cook and White assume that the distribution of applicant quality,  $f(q)$ , is shifted upward or downward by  $h(E,D,U,P)$ . The parameters of  $f(q)$  are assumed to be given.<sup>33</sup> However, if the shape of the applicant quality distribution shifted as  $E,D,U$ , and  $P$  shifted, part of the quality shift observed by Cook and White could be explained in terms of changes in the underlying distribution of applicant quality rather than solely from changes in the proportion accepted for enlistment. For example, in Cook and White's model an increase in draft pressure ( $D$ ) would produce an upward shift in the distribution of applicant quality,

$$f(q)_0 \rightarrow f(q)_1$$

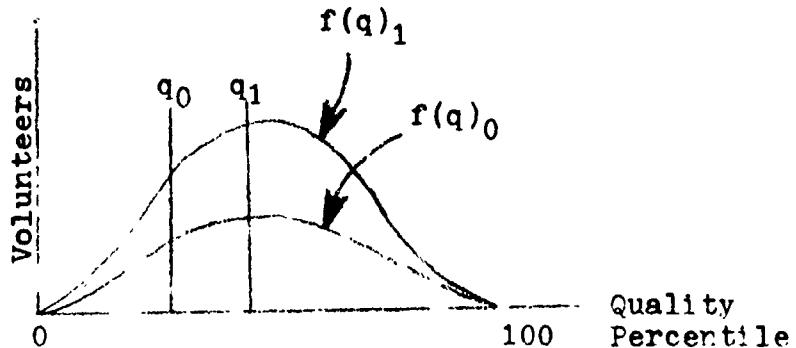


Fig. 3. Effect of Draft Pressure on Quality

<sup>32</sup>Alvin A. Cook, Jr., and John P. White, Estimating the Quality..., p.26.

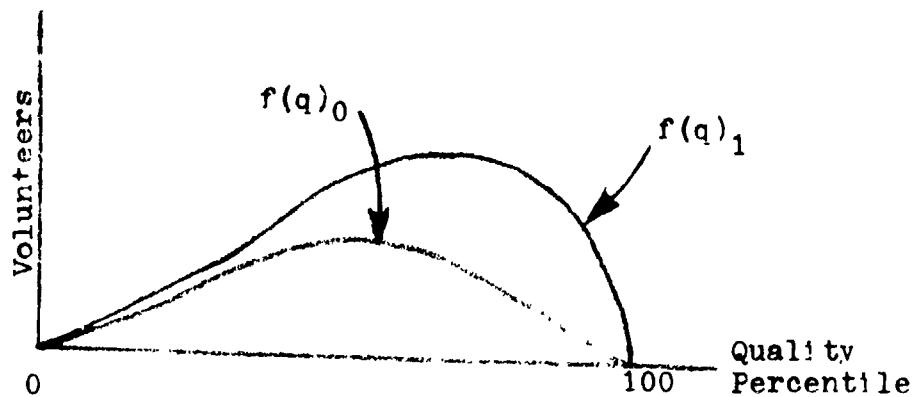
<sup>33</sup>Ibid., p.13.

Assuming requirements ( $R$ ) remained constant, the proportion of qualified applicants accepted for enlistment would decrease. If the Air Force "creams" the applicant population as hypothesized, the minimum quality accepted would increase from  $q_0$  to  $q_1$  where:

$$\int_{q_0}^{100} f(q)_0 dq = \int_{q_1}^{100} f(q)_1 dq = R$$

Average enlistee quality thus increases as enlistments decline as a proportion of the eligible population. However, if high quality individuals were more sensitive to change in draft pressure than low quality individuals, the shape as well as the height of  $f(q)$  would be affected by an increase in draft pressure:

Fig. 4. Effect of Draft Pressure on Quality, Alternative Hypothesis



Under these circumstances, it is not necessary to assume that the Air Force "creams" the applicant population in order to explain enlistee quality. Even if enlistees were selected randomly from the population of qualified applicants, the group selected from  $f(q)_1$  would be of higher quality than the group selected from  $f(q)_0$ .

It can be demonstrated that there are strong theoretical grounds for believing that highly qualified individuals are more sensitive to draft pressure than less qualified individuals. Let  $P_I$ ,  $C_I$ ,  $M_I$ , and  $Y_I$  equal population, civilian monetary wage, military monetary wage, and enlistment applicants for high quality individuals and let  $P_{II}$ ,  $C_{II}$ ,  $M_{II}$ , and  $Y_{II}$  represent similar parameters for a lower quality group. Assume that the distribution of  $d_1$ 's, non-monetary preferences for civilian over military employment, and  $e_1$ 's, preferences for enlistment over induction, are equal at both quality levels. The crucial difference between the high and low quality groups is that while  $M_1$  is equal for all groups, individuals with higher aptitudes tend to have better civilian opportunities ( $C_I > C_{II}$ ). [Cook and White use average  $M$  and  $C$ , without differentiation by quality subgroup.] When the probability of induction,  $p$ , equals zero,

$$M_I^* = (1-d)C_I \quad (1)$$

Since  $C_I > C_{II}$ ,  $M_I^* > M_{II}^*$ . Since  $M_I^*$  must be less than  $M_I$  to induce enlistment, and  $M_I = M_{II}$ ,  $Y_I/P_I < Y_{II}/P_{II}$ , which states that the proportion of high quality individuals enlisting in the absence of a draft is less than the proportion of lower quality individuals. When  $p=1$ , however,  $M_I^* = (1-e)M_I$ , from equation 7. Since  $M_I = M_{II}$ ,  $M_I^* = M_{II}^*$  and  $Y_I/P_I = Y_{II}/P_{II}$ . Therefore, given that  $Y_I/P_I < Y_{II}/P_{II}$  when  $p=0$ , and  $Y_I/P_I = Y_{II}/P_{II}$  when  $p=1$ :

$$\frac{\partial E_I}{\partial p} \cdot \frac{p}{P_I} > \frac{\partial E_I}{\partial p} \cdot \frac{p}{P_{II}}$$

which states that the elasticity of high quality applicants for enlistment relative to draft pressure exceeds the elasticity of lower quality applicants. The above theoretical result will be tested later in this paper.

## 5. Evaluation of Studies Using the Observation Method

The observation method can be used to estimate the quantity and quality of applicants for enlistment and the cost of increasing enlistments to meet manpower requirements. It is dependent on data that can be objectively measured. On these grounds, the observation method is a highly desirable approach to predicting the characteristics of an all-volunteer force.

The current applications of this method are probably unreliable, however. The use of induction rate as an estimator of draft pressure in most of these studies results in an understatement of the effects of draft pressure on enlistment. The elasticities of enlistment relative to draft pressure produced by the observation method are consistently below the estimates produced by other methods.<sup>34</sup> Also, the only study which examined stability (Fechter's) found the estimate of the effects of draft pressure to be highly unstable.

Even if the elasticities developed were reliable, it is doubtful that they would yield a valid projection

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<sup>34</sup> Harry J. Gilman, p.II-1-5.

of enlistments under zero draft. This would require the use of the elasticities over a much wider range than that observed in the original data base.

The theoretical model used as the basis for the estimating equations in these studies is defective, as previously noted. The primary result of this defect is a failure to include variables which measure shifts in preference for enlistment over induction ( $e$ ). However, when draft pressure is heavy,  $e$  is a primary determinant of enlistment rate.

Because of the questionable reliability of the results produced from the observation method, and a desire to rely on conservative estimates of enlistments in the absence of a draft, the Gates Commission relied on survey data rather than on the results of studies using the observation method to estimate the number of volunteers available if the draft was eliminated under present conditions.<sup>35</sup>

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<sup>35</sup>Ibid., p.II-1-6.

## C. Studies Using the Survey Method

The survey method is the most straight-forward approach to estimating the number of enlistments that would take place in the absence of a draft. To estimate the proportion of a particular population that would enlist in the absence of a draft, a questionnaire is administered to all individuals in the population, or a sample of these individuals. The usual basis for estimating the number of individuals who would enlist without a draft ("true volunteers") is a direct question such as the one included in a 1964 DOD survey:<sup>36</sup>

If there had been no draft and you had not had any military obligation at the time you first entered military service, do you think you would have entered the military?  
A. Yes, I definitely would have entered.  
B. Yes, I probably would have entered.  
C. No, I probably would not have entered.

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<sup>36</sup> From 1964 DOD Survey and November, 1969 USAF Sample Survey as quoted in G.L. Brunner, The Importance of Volunteer Status: an Analysis and Reliability Test of Survey Data, R-717-PH, Santa Monica: The Rand Corporation (February, 1970), p.4. (See Foreword.)

- D. No, I definitely would not have entered.
- E. I have no idea what I would have done.

The percentage of "true volunteers" is defined as the number of A. and B. responses over the total response

A.-D.

Although the most direct approach to measuring enlistments in an all-volunteer environment, surveys have several limitations. First, most surveys are based on the responses of enlistees currently on their first term of service. Gilman presents two reasons for assuming that this type of sample will bias the results downward (understate the percentage of true volunteers). "One, the cohorts of those entering in early years, say in 1959 or 1960, who are still classified as first termers have been depleted, through early reenlistments, disproportionately of those who favor military careers."<sup>37</sup> The remaining first-term group is thus not representative of the group that initially entered. "Two, the further away the individual is from his date of entry, the less

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<sup>37</sup> Harry J. Gilman, p.II-1-6.

reliable are his responses as to why he entered in the first place.<sup>38</sup> His feelings tend to reflect attitudes he has formed since joining the military rather than the ones he held before enlistment.

A second major limitation of survey data is its requirement for a subjective judgement on the part of each individual taking the survey. The way an individual indicates he would have acted in a hypothetical situation and the way he actually will act in the situation are sometimes different. Draft avoidance may be used as "a convenient catch-all or excuse" to explain enlistment if an individual's original hopes or objectives in enlistment fail to be realized.<sup>39</sup>

The standard question regarding "draft elimination" in most surveys is somewhat ambiguous. As Fisher points out, the legal "elimination" of the draft and a reduction of draft calls to zero (the more likely alternative at present) with standby authority can have different effects on potential enlistees.<sup>40</sup> Even though no draft calls were

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<sup>38</sup>Ibid., p.II-1-6.

<sup>39</sup>A.C. Fisher, p.250.

<sup>40</sup>Ibid., p.250.

being made at present, the possibility of such calls being made at a future date could induce additional enlistments. Since the question usually used in surveys (previously cited) refers only to a situation in which there is no legal obligation to enlist, it may be eliciting different responses.

Finally, unlike the observation method, the survey method cannot rely on existing source data. A questionnaire must be designed and administered - an expensive process, especially if the population examined is as diverse as the potential enlistee group. For this reason, most survey work has been limited to individuals already in military service, which limits the applicability of the results to the group actually enlisted by the services. As has been demonstrated previously in the Cook and White article, the characteristics of this group may be different from the group applying for enlistment.

### 1. The 1964 and 1968 DOD Surveys

The Department of Defense has sponsored several surveys during the last decade to determine the effect of the draft on enlistees. Of particular interest is a survey of all services conducted in 1964. This survey, because it was taken immediately prior to large-scale U.S. involvement in Viet Nam, is the latest data available for a "peacetime" environment. A similar survey conducted in 1968 found a substantial decrease in the percentage of true volunteers in all services. The estimated percentages of true volunteers in the first-term enlisted force in 1964 and 1968 are contained in TABLE 1. In the 1964 survey, the percentage of true

TABLE 1

Percentage of true volunteers in the first term force, 1964 and 1968

	All Services, Enlisted	Army, Enlisted
1964 Survey	56.5	43.0
1968 Survey	38.8	27.8

Source: Report of the President's Commission on an All-Volunteer Armed Force. Washington: Government Printing Office (February, 1970), p.51.

volunteers in the Air Force first term enlisted force was estimated to be 57.0%.<sup>41</sup>

## 2. Brunner

Users of the 1964 and 1968 surveys are limited in their analysis of the data to responses made to the survey questions. In order to obtain additional information about survey respondents in these two periods, G.L. Brunner matched the social security numbers of all Air Force respondents with their Uniform Airman Record (UAR). This provided additional information about the quality of "true volunteers" obtained before and during Viet Nam and also provided an indication of the quality shifts occurring during this period. Survey data from the 1964 DOD Survey and a 1969 Air Force sample survey were used.

Brunner's analysis of enlistee quality was "interpreted in the light of [the] model constructed by

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<sup>41</sup> Harry J. Gilman, p.II-1-7.

Alvin A. Cook and John P. White."<sup>42</sup> By investigating the percentage of "true volunteers" within quality subgroups in the population, Brunner tested the hypothesis that changes in draft pressure produce equal percentage shifts in each quality group (that is, Cook and White's  $f(q)$  shifts upward or downward but retains the same form). If a difference in percentage of true volunteers was found between quality subgroups, there would be good reason to assume that as  $p$  was reduced to zero,  $f(q)$  would shift in form as well as in height. "However, a two-way analysis of variance clearly indicates that the difference between the [quality] groups is statistically insignificant,"<sup>43</sup> which supports Cook and White's hypothesis. Brunner reports similar finds for differences in educational level and aptitude.<sup>44</sup>

On an a priori basis, Brunner's findings are difficult to explain. As demonstrated in the discussion of Cook and White, there is a strong theoretical argument that draft pressure should affect various quality groups differ-

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<sup>42</sup>G.L. Brunner, p.9.

<sup>43</sup>Ibid., p.2.

<sup>44</sup>Ibid., p.10.

ently, with high quality groups being most sensitive to draft pressure. The findings do lend empirical support to Cook and White's assumption, however.

### 3. Mullins, Massey and Riederich

One limitation of Brunner's work is that it is based on data from all first-term enlistees. This may underestimate the percentage of true volunteers, as previously explained. To accurately reflect an individual's true motives for enlisting, a survey must be administered as close to enlistment as possible. A survey conducted by Mullins, Massey, and Riederich at the Air Force Human Resources Laboratory minimizes this limitation. A questionnaire was administered to 41,098 enlistees during their first week of basic training regarding, among other things, the effect of the draft on enlistment.<sup>45</sup> The study found that 57% of the enlistees tested were true volunteers,

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<sup>45</sup> C.J. Mullins, I.H. Massey, and L.D. Riederich, Why Airmen Enlist, AFHRL-TR-70-29. Lackland AFB, Texas: USAF Human Resources Laboratory (August, 1970), p.1.

based on the same estimating procedures as used in the DOD survey. This is the same percentage as that found for Air Force enlistees in the 1964 survey. Since the percentage of true volunteers has declined in every category since 1964, the results produced in this study are consistent with the hypothesis that a survey of first term enlistees will produce lower estimates of the percentage of true volunteers than a similar survey among new recruits.

The results of surveys are probably the most widely-used estimates of the number of volunteers the military services would obtain in the absence of a draft. However, the subjective nature of survey responses make this method less than ideal. A possible alternative to the survey method which relies on objective information but avoids the problems of the observation method has become available with the initiation of the lottery draft system. Since the first lottery numbers were not announced until December, 1969, few studies of this type have been undertaken. The available studies are described in the next section.

#### D. Studies Based on Lottery Number Distribution

In December, 1969 the Selective Service System instituted a lottery system to determine the order in which eligible individuals would be drafted. The primary objective of the new system was to increase an individual's knowledge of his probability of being drafted.

When the lottery system was initiated, each individual subject to the draft who was over 18 years old on January 1, 1970, was assigned a lottery number based on a random drawing of birth dates (month and day). If an individual's birth date was among the last to be drawn, he would be among the last to be called in his year group. In 1970, individuals in the top third of the sequence (numbers 1-122) were almost certain to be called; those in the middle third (123-244) had an undetermined chance of being called (depending on the actual requirements of the services), and those in the bottom third (245-366) were almost certain not to be called.

The latter group provides the basis for the studies based on lottery distribution (or the "lottery method"

as it will henceforth be called). Individuals in the last third of the lottery sequence are assumed to have, and to perceive themselves to have, a zero probability of being drafted ( $p_1=0$ ). By observing the quantity and quality of volunteers with numbers in the last third of the lottery sequence, an estimate of the quantity and quality of volunteers in the absence of a draft may be made for the entire draft-eligible population. Normally, this estimate is obtained by multiplying the group in the bottom third by three (which assumes it is an estimate of how the other 2/3 of the population would behave in the absence of a draft).

Used in this manner, the lottery method is a simple way to determine the quantity and quality of volunteers available in the absence of a draft. The method is based on objective data, and, since an individual's lottery number can be determined if his birth date is known, most existing data files can be used.

The primary limitation of the lottery method is that it can only be used for individuals who had lottery numbers at the time of their enlistment. This limits the

applicable population to those nineteen and older.<sup>46</sup> Also, the method can be used only to investigate the effect of changing draft pressure on enlistments. All other parameters are assumed to remain unchanged. Finally, the lottery system is so new that experience under it is still limited. 1970 was a transition year to the new system. In many ways (described in Appendix A) the population subject to the draft in that year was not typical of groups to be considered in following years. However, since the distribution of lottery numbers among enlistees fluctuates considerably during the year, at least one year's data must be used to arrive at meaningful conclusions about the underlying population. Therefore, data for 1970 must be used despite its limitations.

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<sup>46</sup> Actually, the definition of the applicable population is somewhat more complex. The exact definition of the subject population examined in this paper and a detailed discussion of its characteristics and limitations are presented in Appendix A.

## 1. Valentine and Vitola

Lottery number data was used in a study conducted by Valentine and Vitola.<sup>47</sup> Using the data collected by Mullins, Massey, and Riederich (examined in the preceding section), Valentine and Vitola defined two sub-groups based on lottery number and survey responses. The first sub-group, referred to as "draft motivated enlistees," consists of individuals who indicated they definitely or probably would not have entered the Air Force in the absence of a draft and who had lottery numbers in the upper third of the lottery sequence. The other group, referred to as "self-motivated enlistees," consists of individuals who indicated they probably or definitely would have entered in the absence of a draft and who had lottery numbers in the bottom third of the lottery sequence.

Valentine and Vitola thus define draft motivation

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<sup>47</sup> L.D. Valentine, Jr., and B.M. Vitola, Comparison of Self-Motivated Air Force Enlistees with Draft Motivated Enlistees, Lackland AFB, Texas: Air Force Human Resources Laboratory, 1970, p.1.

in terms of two indicators - survey response and lottery position. Their results are interesting for two reasons. First, they allow a comparison of a group of individuals who would not have entered the Air Force in the absence of a draft with a group that probably would have entered. Second, the results can be used to test the hypothesis that an individual's lottery number is a good indicator of draft motivation (as measured by survey response). Unfortunately, Valentine and Vitola did not correctly define the group that was subject to the lottery draft in 1970, so this comparison is not entirely valid. Valentine and Vitola assumed that any individual who was nineteen or older upon entering service was in the 1970 lottery. In fact, only those individuals who were nineteen before January 1, 1970 were in the 1970 lottery. Thus, any individual who reached his nineteenth birthday after January 1, 1970 but before he enlisted was assumed to be subject to the 1970 lottery when in fact he was not. Valentine and Vitola report that 20% of the self-motivated group first applied to a recruiter at age 18.<sup>48</sup> Since their sample was drawn from enlistments in April and May,

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<sup>48</sup> Ibid., p.2.

these individuals were probably not 19 on January 1, 1970, which implies at least a 20% error in the estimate of the self-motivated group.

Of the 72 items in the survey, 31 showed responses by the self-motivated and the draft-motivated groups that were different at or near the 1 per cent level of confidence, which far exceeds chance expectations.<sup>49</sup> The differences observed can be summarized as follows:

Compared with draft-motivated enlistees, it was generally found that self-motivated enlistees tended to be less well educated, avoided advanced courses in high school, dropped out of college at an earlier point and perceived their academic performance slightly less favorably ... Aptitude test performance of the self-motivated group was appreciably lower than that of the draft-motivated group.<sup>50</sup>

Valentine and Vitola's findings thus support the hypothesis that the quality distribution among volunteers for enlistment would change if the draft was eliminated, with a higher percentage of the volunteer group being made up of low-

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<sup>49</sup> Ibid., p.3.

<sup>50</sup> Ibid., p.18.

er aptitude individuals. Brunner (see preceding section) contends that Valentine and Vitola's findings are not inconsistent with her results (which indicate no decrease in quality).<sup>51</sup> Brunner states that because Valentine and Vitola eliminated all individuals below age 19, and because they failed to disaggregate for race, their conclusions were not inconsistent with a constant aptitude distribution.<sup>52</sup> However, since Valentine and Vitola found that quality declines as the draft is eliminated in the subgroup they examined, Brunner would have to show an offsetting quality increase in the rest of the population if the findings of the two studies are to remain consistent. Since there is nothing in Brunner's study to indicate such an increase, it appears that the findings of the two studies are inconsistent.

Valentine and Vitola's data yielded mixed results when used to investigate the relationship between lottery number and draft motivation as indicated by survey results. In the bottom third of the lottery sequence (least likely to be drafted), a high proportion of the individuals

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<sup>51</sup> G.L. Brunner, p.20.

<sup>52</sup> *Ibid.*, p.21.

surveyed indicated they would have enlisted in the absence of a draft. However, in the upper third, nearly as many indicated they would have joined in the absence of a draft as indicated they would not have joined.

TABLE 2

Distribution of Responses to Enlistment Attitude Question\*  
by Draft Lottery Sequence

<u>Draft Lottery Sequence</u>		<u>Survey Response</u>						<u>Total</u>
		<u>Definitely Yes</u>	<u>Probably Yes</u>	<u>No Idea</u>	<u>Probably No</u>	<u>Definitely No</u>		
Numbers 1-122	N %	100 12	221 24	234 26	225 25	122 13	912 100	
Numbers 123-244	N %	88 17	158 30	134 26	102 19	42 8	524 100	
Numbers 245-366	N %	81 12	128 41	55 17	40 13	11 3	315 100	

\*If there had been no draft and you had not had any military obligation, do you think you would have entered the service?

Source: L.D. Valentine, Jr., and B.M. Vitola, p.3.

If lottery numbers are a good indicator of perceived draft pressure, the number of draft-induced volunteers ("probably"

or "definitely no" answers) should increase both absolutely and as a percentage of total applicants as lower number groups are examined. This occurs in Valentine and Vitola's data. However, the absolute number of "true volunteers" ("probably" or "definitely yes" answers) should be unaffected by lottery number sequence since they would have volunteered regardless of draft pressure. Although this group decreases as a percentage of the total for low lottery number groups, it increases significantly in absolute numbers. Part of this increase may be explained by defects in Valentine and Vitola's method of defining which individuals had received lottery numbers, but it can be concluded that in its present form the data is not entirely consistent with the hypothesis that lottery numbers are in full agreement with draft pressure as measured by survey data.

## 2. Vitola and Valentine

In a subsequent study, Vitola and Valentine classify a sample of 32,269 Air Force basic trainees by their order in lottery sequence. They define four groups - a high threat (numbers 1-122), moderate threat (123-244) and low threat group (numbers 245-366) among individuals with lottery numbers and a no-threat group of individuals who had not yet received a number.<sup>53</sup> This latter characterization is not valid, since individuals without numbers would be considered for draft in following years. Draft pressure thus probably influenced their enlistment decisions to some degree.

Vitola and Valentine compared the four groups, with particular emphasis on quality differences (as measured by years of education and aptitude scores). The results indicate that aptitude test performance and educational level declined as successively lower draft-threat groups

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<sup>53</sup> Bart M. Vitola and Lonnie D. Valentine, Jr., Assessment of Air Force Accessions by Draft-Vulnerability Category, Lackland AFB, Texas: Air Force Human Resources Laboratory (March, 1971), p.2.

were considered, with a significant decrease taking place in the "no-threat" group. This result was obtained both for the sample as a whole and for racial and geographic subgroups within the sample population. Valentine and Vitola conclude that enlistee quality would decrease if the draft was eliminated.<sup>54</sup>

As in their previous study, Vitola and Valentine find that enlistees with lottery numbers last in the sequence of call are of lower quality than those with numbers in the beginning of the sequence. This lends further support to the existence of a relationship between enlistee quality and draft motivation. However, enlistees rather than applicants for enlistment are examined, so no conclusions can be drawn regarding shifts in the applicant population. Also, Vitola and Valentine misinterpret the cause of the substantially lower level of quality found in the "no-threat" group as compared to the other groups. Since this group is composed of individuals who have not yet received lottery numbers, all individuals must be eighteen or younger. Likewise, those in the other three groups must be nineteen or older. Since most individuals enlist

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<sup>54</sup> Ibid., p.12.

soon after leaving school, the "no-threat" group, because of the age of its members, understandably contains more high-school drop-outs and almost no individuals with education beyond high-school. The low quality of the "no-threat" group does indicate that, even if this group is unaffected by elimination of the draft, the Air Force will have to continue to rely on individuals 19 and older to fill much of its requirement for higher quality individuals:

TABLE 3

Percentage Distribution of Armed Forces Qualifying Test (AFQT)...Mental Ability Categories by Draft Vulnerability Categories

AFQT Category	AFQT Score Range	All	Lottery	Lottery	Lottery	Draft
			Group 1-122	Group 123-244	Group 245-366	Non-Eligible
I	93-100	8	10	9	9	4
II	65-92	37	41	39	34	33
III	31-64	37	34	35	35	42
IV	10-30	18	15	17	17	21

Source: Bart M. Vitola and Lonnie D. Valentine, p.5.

The low quality of the non-eligible, or "no-threat" group also provides additional reason to doubt Brunner's contention (included under the discussion of Valentine and Vitola) that her findings can be reconciled with Valentine

and Vitela's by considering the entire population rather than only those individuals with lottery numbers.

#### E. Conclusion

As previously stated, the purpose of this review of the literature has been to examine existing estimates of the quality and quantity of volunteers in the absence of a draft, determine whether the results of these studies are consistent with each other and with theoretical a priori expectations, and discuss the limitations of each study. In the course of this examination of the literature, several limitations and inconsistencies have been found. The outcome of this paper should contribute toward eliminating some of them. The conclusion to this chapter will describe these limitations and inconsistencies and briefly discuss the manner in which this paper hopes to eliminate them.

All of the studies examined are based on enlistee data rather than on applicant data. They therefore estimate the percentage of the present enlistee group that

would enlist in the absence of a draft, rather than the number of individuals who would apply for enlistment. This difference is especially critical when considering the Air Force, whose enlistee population is usually not representative of the applicant population. Cook and White attempt to compensate for the difference between Air Force enlistee and applicant population in their paper, but their model is based on the as yet unproven contention that the distribution of applicant quality is not changed by draft pressure. This paper will circumvent this problem by using a data source that examines applicants directly.

At present, the observation method is the only approach to the problem of estimating the quantity of volunteers in the absence of a draft that is based on objective data. The survey method uses subjective responses and the lottery method has been used only to make qualitative comparisons between "high threat" and "low threat" groups. This paper will present a method of using lottery sequence information to predict the number of volunteers available in the absence of a draft. The approach is thus based on objective data and avoids many of the limitations of the observation method.

One major inconsistency in the existing work in this area is the disparity between the percentage decrease in volunteers at zero draft estimated by the observation method as compared to survey method estimates. By providing a third means of estimating the number of volunteers in the absence of a draft, this paper will provide evidence supporting the decrease in enlistment found by the observation method or the larger decrease indicated by the survey method.

Finally, by estimating the distribution of aptitude scores and educational levels in the applicant population without a draft, this paper will provide evidence in support of both Brunner and Cook and White's position that applicant quality does not shift under zero draft, or the alternative contention, advanced by Vitola and Valentine, that applicant quality will decrease as draft pressure is reduced to zero.

**Chapter III - The Relationship Between  
Applicants for Enlistment and Draft Lottery  
Numbers**

The intent of the lottery draft system is to give an individual subject to the draft additional information about his probability of being drafted. An individual's lottery sequence number determines how many others will be drafted before he is inducted.

Lottery numbers do not indicate with complete certainty just who will be drafted, however. A particular individual's chances of being drafted are affected by the number of persons with numbers lower than his who choose to enlist rather than be drafted and by the size of the draft calls made by the Department of Defense. Also, since each draft board fills its quota from the pool of potential inductees registered at that board, an individual's chances of being drafted are affected by the distribution of lottery numbers among the registrants at his board. In 1970, the Selective Service Administration took steps to insure that the highest number called

did not vary widely from board to board. This was done by forbidding the local boards from calling numbers higher than a specified limit and instructing the state directors to reallocate quotas as necessary within each state.<sup>55</sup> However, some variation in the highest number called still occurred between boards. Thus, even with the lottery system, an individual cannot be entirely certain that he will or will not be drafted.

#### A. The Expected Relationship Between the Number of Applicants and Lottery Sequence Numbers

An individual's lottery number affects his perceived probability of being inducted ( $p_1$ ). In the theoretical relationship developed in Chapter II, an individual's military reserve wage ( $M_1^*$ ) is a function of net non-monetary preference for civilian over military employment ( $d_1$ ), net non-monetary preference for enlistment over induction ( $e_1$ ), expected civilian income ( $C_1'$ ), military

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<sup>55</sup>U.S., Selective Service Administration, Semi-Annual Report of the Director, January 1-June 30, 1970 (Washington, D.C.: Government Printing Office, 1970), p.3.

pay ( $M_1$ ) and  $p_1$ :

$$M_1^* = (1-d_1) \left[ p_1 (1-e_1) M_1 + (1-p_1) C_1' \right] \quad (7)$$

If the individual's perceived returns from service as an inductee are less than his expected civilian income

$\left[ (1-e_1) M_1 < C_1' \right]$ .  $M_1^*$  will decline as  $p_1$  increases. As previously demonstrated in Chapter II, this causes  $M_1$  to exceed  $M_1^*$  for some individuals in the population who formerly chose not to enlist. Therefore, as  $p_1$  increases, the number of enlistments from a particular population can also be expected to increase.

The individuals who hold a particular lottery number can be thought of as a random sample of the over-all population subject to the lottery. Since the only characteristic they have in common is a common birth date, the distribution of  $C_1'$ 's,  $e_1$ 's, and  $d_1$ 's held by individuals with a given lottery number can be expected to be the same as that existing in the entire group subject to the lottery. The distribution of these characteristics in the group associated with a particular lottery number is thus an unbiased estimator of the distribution existing in the population subject to the lottery.

$M_1^* = g(d_1, e_1, C_1^*, M_1, p_1)$ , so if  $M$  and  $p$  are the same for each group, the number of applicants from each group can be expected to be the same.

$M_1$ , the military wage, is the same for all members of the population, but  $p_1$ , the perceived probability of being drafted, is affected by the lottery sequence number assigned to the group of individuals sharing a common birth date. Differences in  $p_1$  will cause the distribution of  $M_1^*$ 's in groups holding different lottery numbers to differ, resulting in a different number of applicants from each lottery group:

Number of  
Applicants

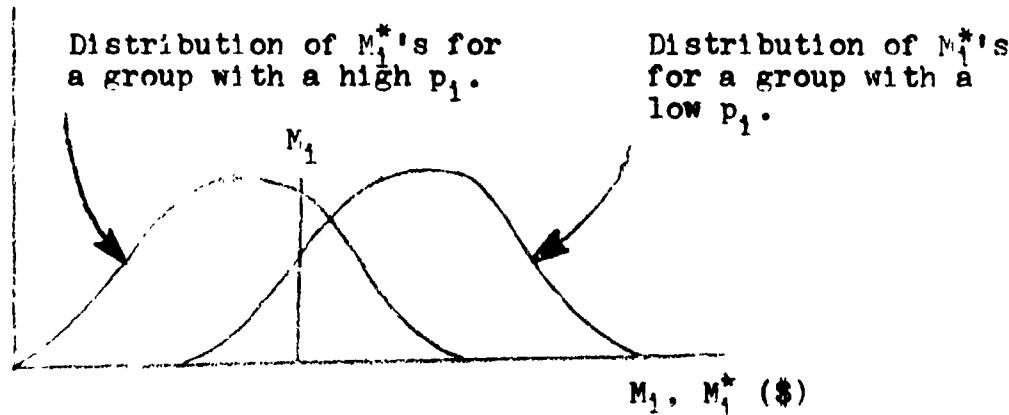


Fig. 5. Applications for Enlistment From Two Groups Holding Different Lottery Numbers

The number of applicants from each lottery number group equals the area under the curve to the left of  $M_1$  in Fig. 5. above.

Generalizing from the above relationship allows a functional relationship to be established between the number of applicants having a particular birth date ( $A_D$ ) and the lottery sequence number assigned to that date ( $L_D$ ).

$$A_D = h(L_D) \quad (8)$$

The nature of this functional relationship depends on the  $p_1$  perceived by individuals with a particular lottery sequence number. If every individual's lottery number indicated whether he would or would not be drafted, every person in the population would have a  $p_1$  of 1 or 0. This would be equivalent to announcing that all individuals above a particular lottery number would be drafted and that all those below that number would not be drafted. Assuming that  $C'$ ,  $d$ , and  $e$  equal their expected values in each of the lottery number groups, the function relationship between applicants and lottery numbers would assume the following form:

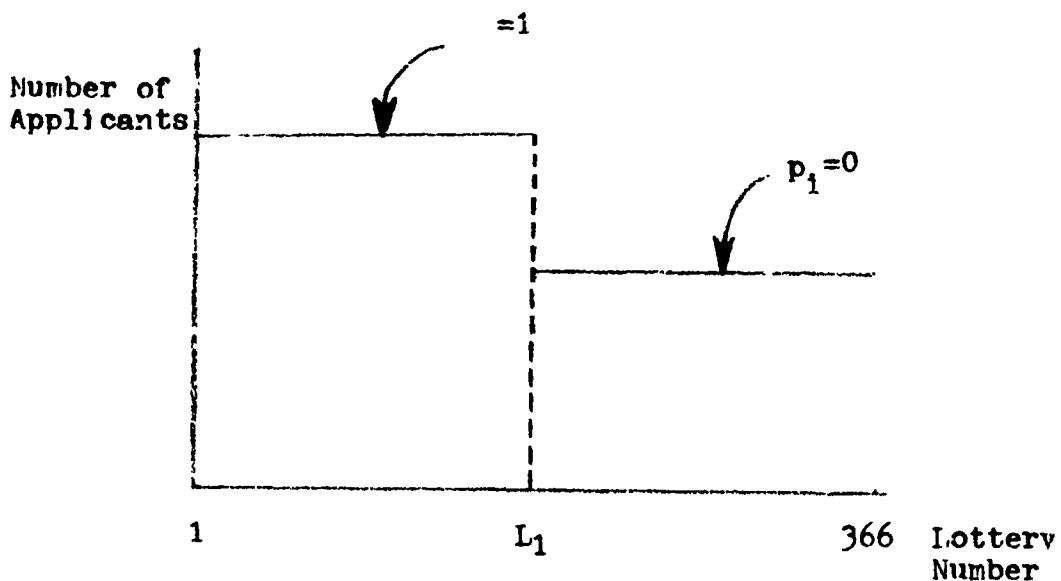


Fig. 6. Theoretical Behavior of Applicant Population Under Certainty

where  $L_1$  is the highest number drafted.

In actuality, however, lottery numbers do not allow an individual to be certain he will or will not be drafted. Those with numbers high in the random sequence can be certain they will be called, while those with numbers low in the sequence can be certain they will not be called. Between these two extremes, however, individuals may or may not be called, depending on number of individuals eventually drafted, the number of persons with low numbers who choose induction over enlistment, and the particular situation existing at their local draft boards. These individuals perceive a  $p_1$  somewhere between zero and

one.<sup>56</sup> Under these conditions, the relationship between number of applicants and lottery number becomes:

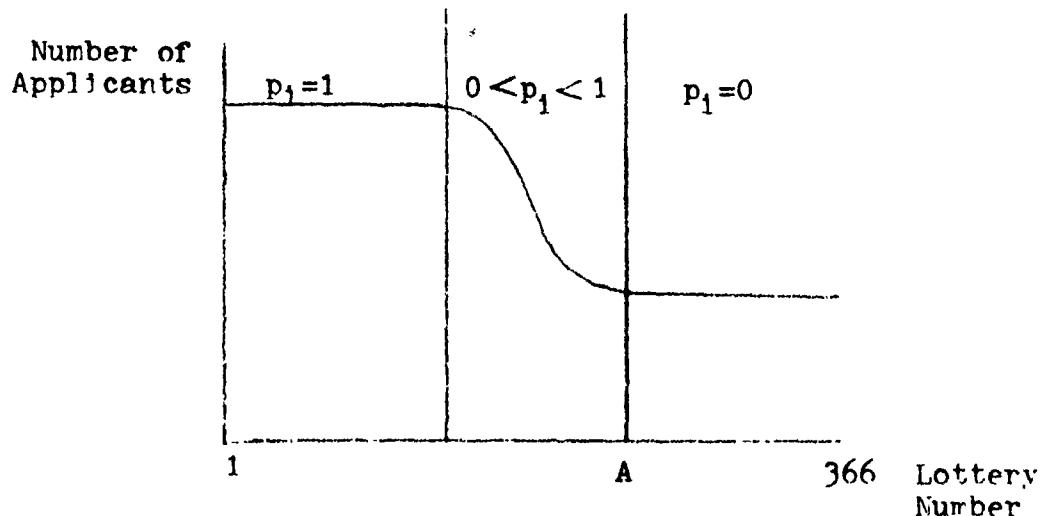


Fig. 7. Theoretical Behavior of Applicant Population Under Uncertainty

Although persons who are extremely low in the random sequence would not be called unless a grave national emergency developed, they are not entirely free from the threat of being drafted. They are in a situation similar to that which would exist for the entire population if draft calls were reduced to zero. As mentioned in the

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<sup>56</sup>Shortly after the 1970 lottery sequence numbers were drawn, it was announced that those with numbers in the upper third of the sequence were almost certain to be drafted, those with numbers in the last third were almost certain not to be drafted, and those in the middle third might or might not be drafted, depending on conditions. (See for example: New York Times (December 2, 1969), p.1).

discussion of the Fisher article, this is not the same as the elimination of the statutory authority to induct men into the armed forces. However, at the present time it appears that standby induction authority will be maintained if an all-volunteer force is implemented, so the draft pressure currently perceived by men at the bottom of the order of call is probably about the same as the pressure on the entire population in the absence of a draft.

#### B. Actual Distribution of Applicants by Lottery Number

A random sample of 15% of the individuals applying for Air Force enlistment in 1970 was selected to test the relationship hypothesized above. For each member of the sample population, the following data items were recorded: lottery number, date of enlistment application, years of education, birth date, indicated interest in Air Force enlistment, sex, and Airman Qualifying Examination mental aptitude scores. A detailed description of the sample and the sampling process is contained in Appendix A.

To determine if the relationship between number of

applicants and applicant lottery numbers assumed a form similar to that described above, the sample population was plotted by draft lottery number. Before examining the nature of the relationship, however, the data was smoothed to reduce the random variation existing between the groups associated with each lottery number.

Random variation within the sample population results from two sources. First, as was previously described, the individuals holding a particular lottery number constitute a random sample from the population with lottery numbers. The distribution of  $C_j^i$ ,  $e_j$ , and  $d_j$  within the group holding a particular number is therefore expected to be an unbiased estimate of the distribution of these parameters within the population. However, the values of these parameters associated with each lottery number "sample" will be distributed around the population values rather than being equal to these values in every case (which was the assumption made in the preceding section). Random variation in the distribution of  $C_j^i$ ,  $d_j$ , and  $e_j$  in the individual lottery number groups will result in random variations in the number of applicants from each group. The second source of random variation existing in the sample data used in this study is the use of a

15% sample to estimate the applicant population. Even if each lottery number group assumed its expected value in the total lottery population, some random variation would still exist in the sample data due to sampling error.

Random variation in the sample data was reduced by grouping the applicants associated with each lottery number into cells of ten lottery numbers each and then smoothing the cell totals with a six cell moving average. The thirty-seven cell totals were formed by adding individual lottery number totals, beginning with numbers 1-10. The thirty-seventh cell (numbers 361-366) was multiplied by 1.66 to maintain a constant cell interval. Since no cyclical trend appears to exist in the data, moving averages of varying size were tested and a six cell moving average selected as adequate to remove random variation. When applied to the sample data, the distributions in Fig. 8 and Fig. 9 result.

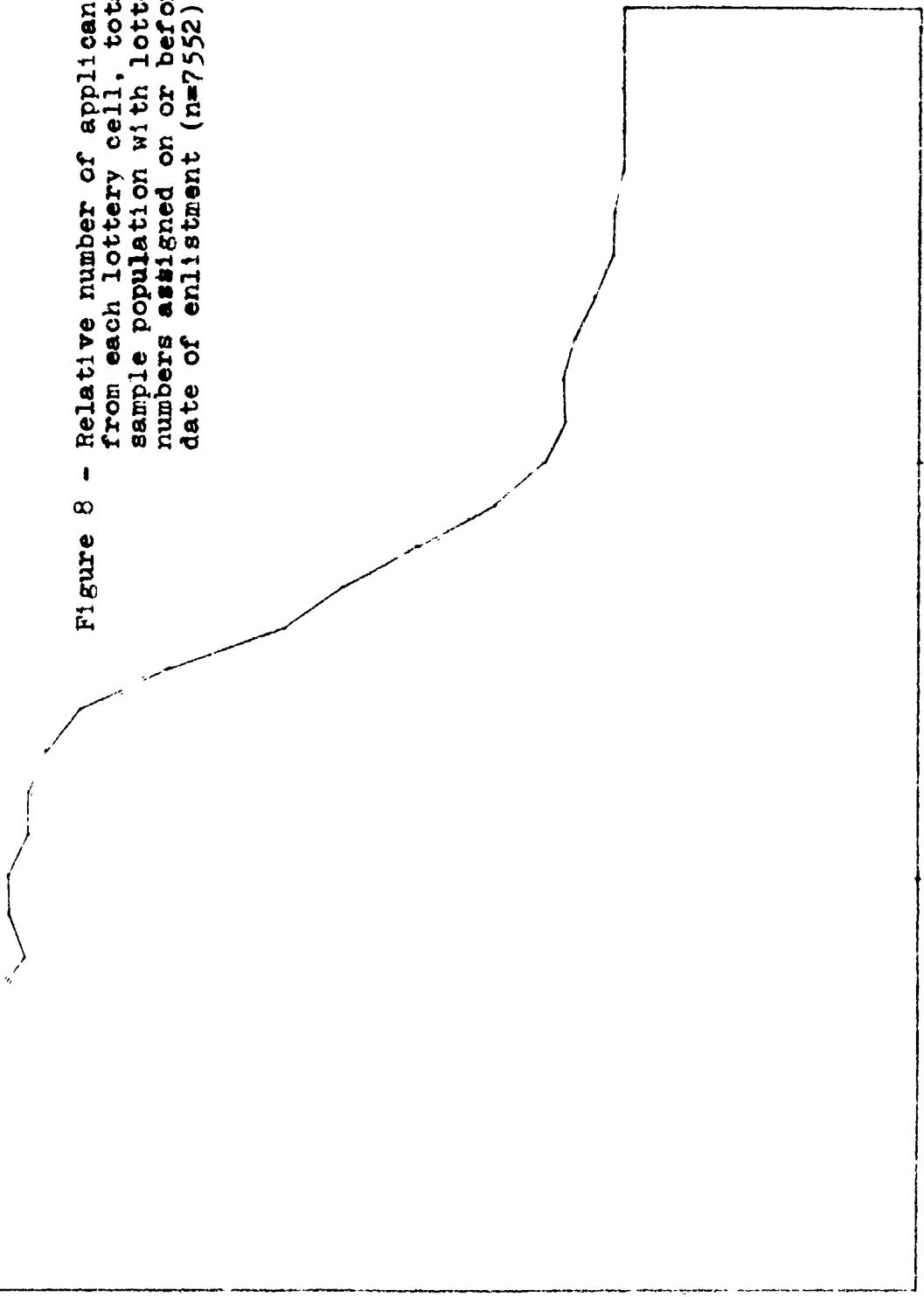
The shape of the distributions shown in Fig. 8 and Fig. 9 agrees with the theoretical relationship hypothesized in Fig. 7. The highest cell number shown in these figures (and all other figures of this type within this paper) is 311-320. This is due to the fact that the six cell moving average was applied to the cells lowest in the sequence

Relative Number of  
Applicants

Figure 8 - Relative number of applicants from each lottery cell, total sample population with lottery numbers assigned on or before date of enlistment (n=7552)

94.

320  
200  
100  
Lottery  
Number



Relative Number of  
Applicants

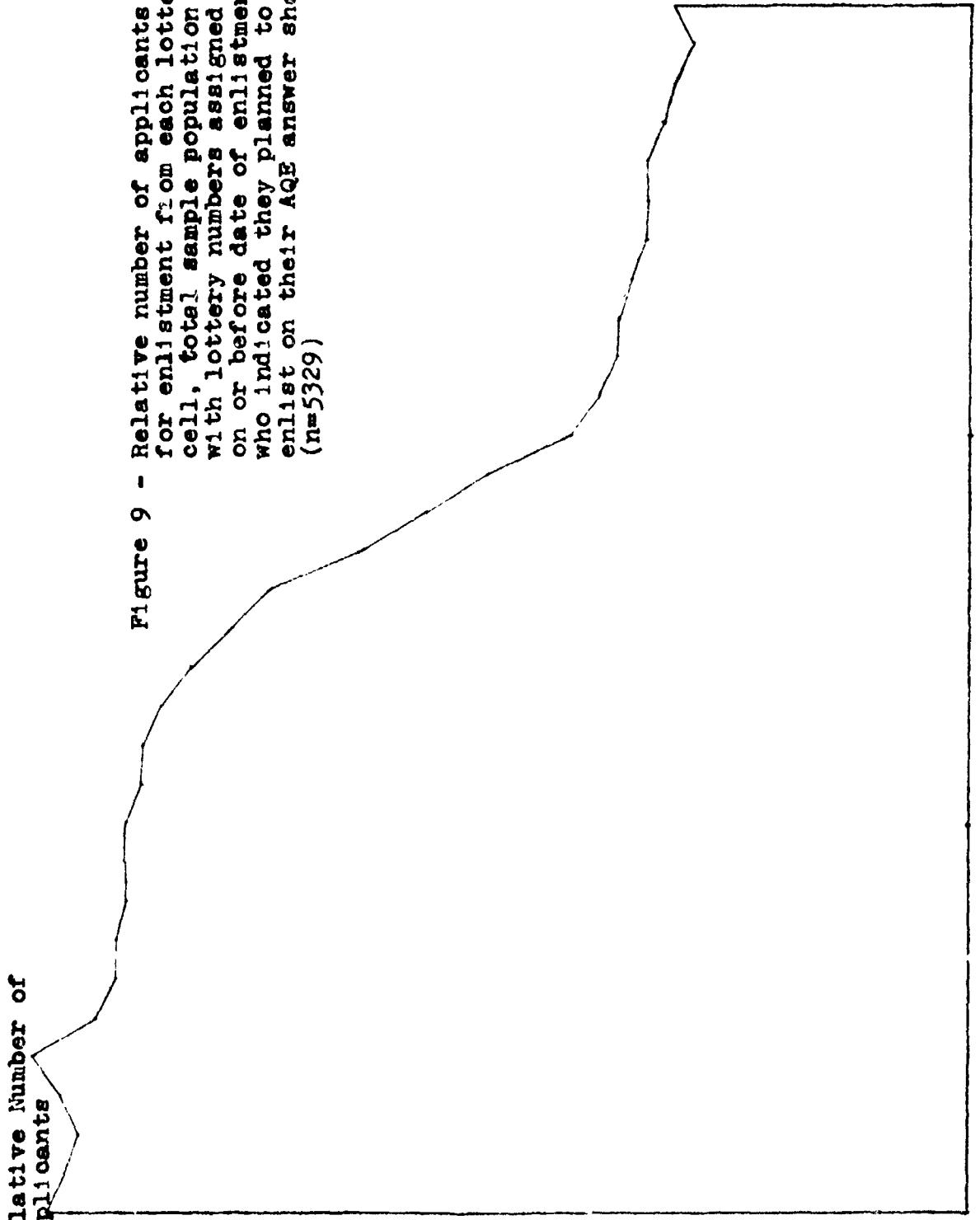
Figure 9 - Relative number of applicants for enlistment from each lottery cell, total sample population with lottery numbers assigned on or before date of enlistment who indicated they planned to enlist on their AQE answer sheet (n=5329)

95.

320  
Lottery  
Number

200

100



first. The values appearing in the figures are the relative values of the moving average for the cell entering the moving average. Figure 8 illustrates the distribution of lottery numbers within the sample population, while figure 9 further restricts the population considered to these individuals indicating a desire to enlist on their applications. Little difference can be observed between the two distributions.

#### C. Estimating the Proportion of "True Volunteers" and the Number of Applicants in the Absence of a Draft

"True Volunteers" have been previously defined as individuals who would volunteer in the absence of a draft, or when  $p_1=0$  for the entire draft eligible population. Since the present sample population conforms to the distribution illustrated in Fig. 7, a portion of the present sample population appears to have a perceived probability of being drafted which approaches zero. Applications from these groups probably would be unaffected by the elimination of the draft. By observing the number of applications

being received with lottery numbers low in the random sequence, the behavior of the rest of the lottery number groups in the absence of a draft can be estimated.

The studies by Valentine and Vitola define their "low threat group" as the bottom third of the order of call. This can be defended as a conservative estimate of the "low threat" or "true volunteer" group because it reflects the initial 1/3-1/3-1/3 guidelines announced when the lottery was held and because all numbers in the group are well below the lowest number actually called.<sup>57</sup> Since Valentine and Vitola were interested only in examining the characteristics of the low-threat group, a conservative estimate was sufficient for their purposes. In this study, however, the size of the low-threat group as a portion of the applicant population is of central importance. A more precise method of identifying the extent of the "low threat" group will be used.

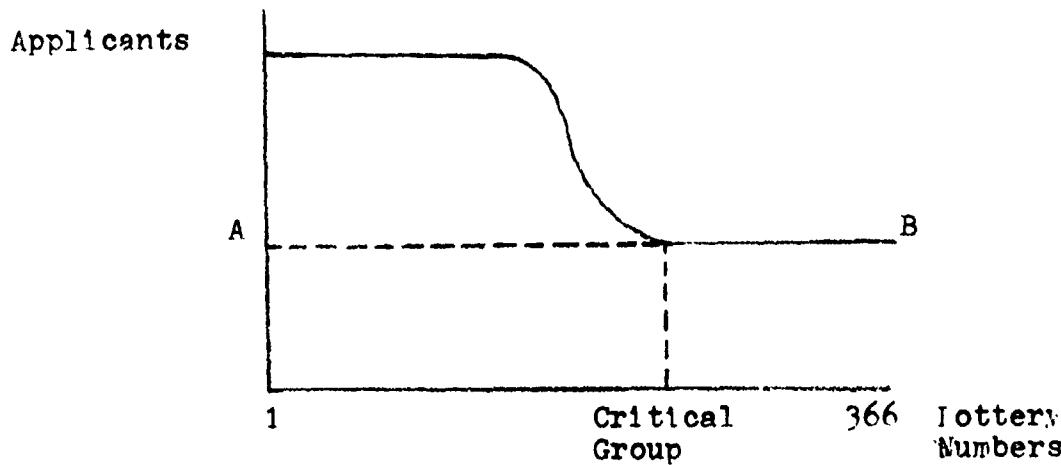
The "low threat" or "true volunteer" group is shown in Fig. 7. as the portion of the applicant population

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<sup>57</sup> In July of 1970, the Director of Selective Service announced that the highest number called in 1970 would be 195. U.S., Selective Service Administration, Semi-Annual Report of the Director, July 1-December 31, 1970.

that has a perceived probability of being drafted equal to zero. The extent of this group in the sample can be defined by locating point A, the lottery sequence number where perceived probability of being drafted is high enough to induce a significant increase in applications for enlistment. The lottery number cell corresponding to point A will be referred to as the "critical group." Since all applicants with numbers higher than the critical group are unaffected by draft pressure, they are all "true volunteers." Furthermore, in the absence of a draft, all individuals in lower number cells would behave in a similar manner (that is, only true volunteers would enlist). Fig. 10 depicts this relationship, with the number of applicants in the absence of a draft being shown as the area under line AB.

Fig. 10. Estimating the Number of True Volunteers



Only one assumption about the functional form of the relationship between number of applicants and lottery number is necessary in the estimation technique described above. Individuals from the high number cells must in fact have a  $p_1=0$ , meaning that above some point in the lottery sequence, lottery sequence position must have no effect on applications for enlistment. This assumption was tested in the sample data using a conservative estimate of the portion of the population having  $p_1$  equal to zero. The mean lottery number for each of the highest 12 lottery number cells was regressed on the number of applicants from each cell. Cells from the entire sample indicating interest in Air Force enlistment were tested. In both cases, it could be stated with 95% confidence that the beta value was not different from zero.<sup>58</sup> Since any lottery number in the highest 12 cells thus appears to have an equal effect on enlistments, the point at which  $p_1=0$  has been reached and applicants from these cells can

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<sup>58</sup>For the entire population, beta was found to equal -2.12 (a decrease of 2.12 applicants for each 10 number increase in the lottery sequence). For the portion of the population indicating an interest in enlistment, beta equaled -1.06. Use of an F test revealed that neither value differed significantly from zero.

be accepted as "true volunteers."

To find the critical group, the number of applicants from each lottery number cell in the population was compared with the cell mean for the bottom twelve cells. Cells were tested in inverse order: A one-tail t test was used to determine when the number of applicants in three consecutive cells were found to be higher than the mean of the bottom twelve cells with 97.5% confidence.<sup>59</sup> The proportion of "true volunteers" in the applicant population is estimated by multiplying the number of cells (37) by the mean number of applicants per cell in the cells above the critical group and then dividing by the total applicant population. Referring to Fig. 10, this is equivalent to dividing the area under AB by the total number of applicants. The estimated number of "true volunteers"

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<sup>59</sup> The t value (with 11 d.f.) used was 2.201. Criteria to reject the hypothesis that a cell total  $x$  did not differ significantly from  $\bar{x}$  was thus

$$x \geq \bar{x} + 2.201s_{\bar{x}}, \text{ where } s_{\bar{x}} =$$

$$\text{and } \bar{x} = \frac{\sum_{i=1}^{12} x_i}{12}$$

$$\sqrt{\frac{\sum_{i=1}^{12} (x_i - \bar{x})^2}{n(n-1)}}$$

is in itself interesting as an indication of the number of volunteers in the absence of a draft. Applying this technique to the total population and to the portion of the population indicating they desired to enlist in the Air Force produced the following results:

TABLE 4

Effects of Draft Pressure on  
the Sample Population

	Total Population	Portion Desiring AF Enlistment
Current Applicants	7552	5329
Critical Group	241-250	241-250
Percent True Volunteers	51.5	50.0
Applicants in the Absence of a Draft	3888	2678

Once again, no difference can be detected in the distribution of individuals indicating a desire for Air Force enlistment and the distribution in the total population.

The percentage of draft motivated enlistments is equal to 100 minus the percentage of true volunteers. The estimate of draft motivated enlistments resulting from this method is below the estimate resulting from

the survey method. However, it is substantially above the percentage decreases in enlistments estimated by Fechter, and Cook and White. The results of these studies are not entirely compatible, however. All were based on data from time periods prior to the implementation of the lottery system. Furthermore, Fechter's findings apply only to Army enlistments.

This chapter has empirically confirmed theoretical expectations about the nature of the relationship between enlistment and position in the draft lottery sequence. Furthermore, a method of estimating the total number of applications for Air Force enlistment in the absence of a draft has been developed and used to predict an approximate 50% decline in enlistments. This estimate does not indicate the military's supply of eligible manpower in the absence of a draft, however. Estimates for the total population do not indicate the proportional decrease in the applicant group eligible for enlistment or the distribution of mental aptitudes within the eligible population. The next chapter will examine shifts in the distribution of mental aptitudes within the applicant population when the draft is reduced to zero and produce an estimate of the proportion of eligible true volunteers in the 1970 applicant population.

#### Chapter IV - The Relationship Between Applicant Quality and the Draft

Any discussion of the ability of the Air Force to meet its enlistment needs in the absence of a draft must include an examination of expected enlistee quality. As indicated in the last chapter, quality must be considered in any examination of the over-all applicant population as a means of identifying the applicants who are mentally qualified for enlistment. Even an estimate of the mentally qualified population is not enough, however, since the Air Force states its manpower requirements in terms of mental aptitude scores that in most cases are considerably above the minimum for entry. To fully satisfy the Air Force's manpower requirements, the distribution of enlistee mental quality must match or exceed its requirements, as well as provide the required number of new enlistments.

#### A. Predicting the Distribution of Applicant Quality in the Absence of a Draft

To control the distribution of mental aptitudes held by Air Force enlistees, separate recruiting quotas are issued for each of the four Airman Qualifying Examination score areas (mechanical, administrative, general and electronic). Each quota stipulates the minimum percentile score in the specified AQE area which an applicant must hold in order to enlist against that quota. In each of the four AQE areas, quotas are issued for individuals with scores above the 40th percentile, above the 60th percentile, and above the 80th percentile, although no quotas are being issued for some of these percentile groups at the present time. For example, no quotas currently exist for mechanical scores above 80. The percentile scores are minimum requirements. No maximum limits are imposed.

To determine the changing ability of the Air Force to fill quality requirements of this type in the absence of a draft, the model developed in the preceding chapter was applied to AQE percentile score subgroups in each of

the four AQE areas. To develop the data base required for this examination, the sample was first sorted on mechanical score into the following five percentile score groups:

00-24  
25-39  
40-59  
60-79  
80-99

Similar sorts of the sample were completed for administrative, general and electronic scores. Since each individual has a score in each area, the group with lottery numbers was included in each sort.

The highest three percentile groups in the above sorts reflect the current method of assigning enlistment quotas. The 25-39 group indicates the number of individuals who would become available if aptitude standards were decreased 10-15 points in each area. The 00-24 group consists of applicants who would not be eligible for enlistment unless there was a major decrease in present mental aptitude standards.

Applying the zero-draft model to the percentile sub-groups for each of the four area scores produced the results displayed in TABLES 5 - 8. The results of applying the model to similar groupings for years of education are

contained in TABLE 9. Relative frequency distributions for each subgroup are contained in Appendix B.

TABLE 5

Results of Applying the Zero-Draft Model to Sample Mechanical AQE Percentile Sub-groups  
(Percentage figures in parenthesis)

Percentile Group	00-24	25-39	40-59	60-79	80-99
Current Applicants	802 (10.6)	805 (10.7)	1920 (25.5)	1980 (26.3)	2025 (26.7)
Critical Group	201-210	201-210	201-210	261-270	201-210
Percent True Volunteers	81.1	61.1	62.1	44.8	39.1
Applicants in the Absence of a Draft	642 (16.0)	492 (12.3)	1193 (29.8)	888 (22.2)	792 (19/8)

TABLE 6

Results of Applying the Zero-Draft Model to Sample Administrative AQE Percentile Subgroups  
(Percentage figures in parenthesis)

Percentile Group	00-24	25-39	40-59	60-79	80-99
Current Applicants	896 (11.5)	660 (8.8)	1725 (22.9)	1959 (26.0)	2325 (30.8)

TABLE 6 - Continue<sup>a</sup>

Critical Group	171-180	191-200	201-210	261-270	201-210
Percent True Volunteers	82.8	70.4	58.3	45.0	41.4
Applicants in the Absence of a Draft	720 (17.8)	465 (11.5)	1006 (24.9)	881 (21.8)	962 (23.8)

TABLE 7

Results of Applying the Zero-Draft Model  
to Sample General AQE Subgroups  
(Percentage figures in parenthesis)

Percentile Group	00-24	25-39	40-59	60-79	80-99
Current Applicants	600 (7.9)	629 (8.3)	1571 (20.8)	2194 (29.1)	2545 (33.7)
Critical Group	91-100	211-220	241-250	201-210	211-220
Percent True Volunteers	91.4	66.2	57.4	52.3	38.4
Applicants in the Absence of a Draft	548 (13.7)	416 (10.4)	902 (22.6)	1147 (28.7)	978 (24.5)

TABLE 8

Results of Applying the Zero-Draft Model to  
 Sample Electronic AQE Subgroups  
 (Percentage figures in parenthesis)

Percentile Group	00-24	25-39	40-59	60-79	80-99
Current Applicants	576 (7.6)	816 (10.8)	1704 (22.6)	1704 (22.6)	2739 (36.3)
Critical Group	81-90	201-210	201-210	261-270	231-240
Percent True Volunteers	93.7	72.8	61.1	44.4	38.3
Applicants in the Absence of a Draft	540 (13.5)	594 (14.9)	1040 (26.1)	757 (19.0)	1049 (26.3)

TABLE 9

Results of Applying the Zero-Draft Model to  
 Sample Educational Subgroups  
 (Percentage figures in parenthesis)

Years of Education	1-10	11-12	13-14	15-16	Over 16
Current Applicants	261 (3.5)	3937 (52.8)	1959 (26.3)	1184 (15.8)	106 (1.4)
Critical Group	161-170	201-210	201-210	221-230	201-210
Percent True Volunteers	89.8	61.6	51.3	24.6	34.9

TABLE 9 - Continued

Applicants in the Absence of a Draft	234 (5.8)	2425 (60.7)	1006 (25.1)	291 (7.2)	37 (.9)
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If the applicant population in the absence of a draft was to have a distribution of quality similar to the present population, as hypothesized by Cock and Brunner, the percentage of "true volunteers" in each aptitude subgroup in the sample should not be significantly different. However, in each of the five quality indices examined, the percentage of true volunteers differed widely. Furthermore, in all but two cases the percentage of true volunteers decreased as applicant quality increased.<sup>60</sup> The data

<sup>60</sup> In one case, observed in the distribution of mechanical scores, the difference between the two groups (25-35 and 40-55) was not significant. In the other case (15-16 and Over 16 years of education), the under-representation of the December, 1969 population in the sample probably resulted in an over-estimate of the percentage of true volunteers for the Over 16 years of education group (see Appendix A). Since the Over 16 group is predominately made up of graduate students who no longer hold college deferents, all individuals in the group who were assigned low numbers had to enlist immediately to avoid the draft. The low December, 1969 sample thus probably produced an underestimate of applicants with low numbers from the Over 16 group, with a resultant over-estimation of the percentage of true volunteers for this group.

therefore supports the alternative hypothesis that high quality individuals will decrease both absolutely and as a percentage of the applicant population if the draft is eliminated.

#### B. Requirement for a Single Quality Index

Unfortunately, the above information does not allow the Air Force's manpower quality requirements to be compared with the quality distribution in the absence of a draft. Section A contains the expected distribution of percentile scores in each of the four AQE areas. Each individual in the sample is included in all of the four area distributions. However, he can be allocated to a quota under only one of his AQE scores. For example, suppose that an individual receives the following AQE scores:

Mechanical-----	75
Administrative---	70
General-----	85
Electronic-----	85

If the individual is enlisted against a general 80 quota

(a quota requiring at least a General 80 score), he would not be available to fill a quota in any of the other three AQE areas. His scores would effectively be removed from the quality distribution of available applicants in the other three AQE areas because he must be assigned to a job using a General selector AQE.

The question of whether or not a given group of applicants is sufficient to meet Air Force requirements depends in part on how efficiently the Air Force allocates potential enlistees to AQE area quotas. Also, a shortage may occur in different AQE areas for a given enlistee population and set of aptitude requirements depending on the priorities assigned to filling the various quotas. The determination of whether or not a set of applicant AQE scores is sufficient to meet Air Force quality requirements thus becomes inexorably bound up with the allocation process used in assigning individuals to quotas and, finally, to individual Air Force occupational areas.

Allocation becomes a factor because applicant quality and Air Force requirements are expressed in terms of four different AQE 'rdexes. If applicant supply and Air Force requirements could be expressed in terms of a single index,

allocation would no longer enter into the problem of matching manpower supply with requirements.

There is good reason to believe that an individual's four AQF scores could be expressed in terms of a single index due to the high correlation between scores found in the sample population. For the sample data, the coefficients of correlation between the four AQE area scores were high for nearly every combination of AQE score.

TABLE 10  
Simple Correlation Matrix,  
Sample AQE Scores and Education

	Mechanical	Administrative	General	Electronic
Administrative	.644			
General	.793	.871		
Electronic	.812	.781	.857	
Education (Yrs.)	.357	.476	.459	.414

The particularly high correlation between general area scores and the other three area scores suggests that the other three scores reveal little additional information about an individual's mental aptitude. Although not

significantly related to AQE, the coefficient of correlation between education and each of the area AQE scores was positive in every case, as expected.

#### C. Development of a Single Index for Mental Aptitude

In a 1968 study, Valentine observed a high correlation between each of the four AQE area scores and score on the AFQT. Valentine retested 1,076 enlistees soon after entry into basic training. One group (Group A) of 537 enlistees was administered the AFQT and then the AQE. The other group (Group B) received the tests in the opposite order. The combined sample thus allowed for any practice effect which might result from taking the tests in a particular order.<sup>61</sup> Using the combined sample, Valentine found the following coefficients of correlation:

<sup>61</sup> L.D. Valentine, Jr., Relationship Between Airman Qualifying Examination and Armed Forces Qualifying Test Norms AFHRL-TR-68-106. Lackland AFB, Texas: USAF Human Resources Laboratory, 1968, p.2.

TABLE 11

**Correlation Between AQE and AFQT**  
**Aptitude Indexes**  
**(based on retest data)**

AQE Area Indexes	r values (with AFQT)
Mechanical	.80
Administrative	.68
General	.78
Electronic	.83

Source: I.D. Valentine, Jr., Relationship Between Airman Qualifying Examination and Armed Forces Qualifying Test Norms AFHRL-TR-68-106, ...p.3.

The high correlation between AFQT and each of the AQE area indexes indicates that AQE area scores were probably highly correlated with each other in Valentine's data. AQE scores thus appear to be highly correlated with each other and with another general mental aptitude index, the AFQT. Any one of these five indexes could be used as an overall index of aptitude with little loss of information resulting from the omission of the other four scores.

Although applicant quality can be stated in terms of any one of the five indexes mentioned above, Air Force quality requirements are stated in terms of all four AQE indexes, making it impossible to state requirements in

terms of one AQE index. However, as will be seen in the next chapter, requirements can be stated in terms of a distribution of AFQT scores. AFQT score would therefore be the best single index to express the supply of and the requirements for mental aptitude, assuming that the distribution of AFQT scores in a zero-draft applicant population can be determined.

In his paper concerning the relationship between AFQT and AQE scores, Valentine derives a conversion table which allows an individual's AFQT score to be predicted from any one of his AQE indexes.<sup>62</sup> Based on Valentine's conversion table, the AFQT score of each individual in the sample was predicted based on the general AQE score. The general score was chosen as the basis for conversion because of its high correlation with the other three AQE area scores in the sample and the high correlation with AFQT score observed by Valentine.

Based on the AFQT equivalent to his general score, each individual with a lottery number in the sample was classified into one of the five mental groups shown in TABLE 3 (Category V consists of the ninth percentile and

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<sup>62</sup> *Ibid.*, p.4.

below). The AFQT percentiles associated with each general score fell entirely within one of the five AFQT mental groups, except for the percentile scores associated with a general 65 score. Assuming that individuals with a general 65 are evenly distributed over the equivalent AFQT percentile scores, half were in mental Category II and half were in mental Category III.

The zero-draft model was applied to the applicant distribution in each of the five mental categories and to the aggregations of Categories I-IV and I-III. The results from the application of the model are contained in TABLE 12.

TABLE 12

Results of Applying the Zero-Draft Model  
to AFQT Mental Categories  
(Percentage of total categories I-V in parenthesis)

	AFQT Mental Categories				
	I	II	III	IV	V
Current Applicants	866 (11.8)	2877 (38.2)	2547 (33.8)	1187 (15.7)	42 (.6)
Critical Group	211-220	201-210	211-220	191-200	-
Percent True Volunteers	38.1	44.8	57.0	77.2	-

TABLE 12 - Continued

## AFQT Mental Categories

	I	II	III	IV	V
Applicants in the Absence of a Draft	338 (8.3)	1290 (31.9)	1451 (35.9)	917 (22.7)	42 (1.0)

TABLE 13

Results of Applying the Zerc-Draft Model  
to AFQT Mental Categories...  
(Continued)

## AFQT Mental Categories

	I-IV	I-III
Current Applicants	7497 (99.4)	6310 (83.7)
Critical Group	201-210	241-250
Percent True Volunteers	54.0	46.7
Applicants in the Absence of a Draft	4050 (99.1)	2949 (76.3)

As was the case with AQE data, the proportion of true volunteers was inversely related to mental aptitude. In the lowest mental aptitude group (Category V), position 'n the lottery sequence had no significant effect on applications for enlistment. Regardless of his lottery number, an individual in Category V would be exempt from the draft because his mental aptitude is below the minimum for military service in any capacity. Applicants from this mental category could therefore be expected to be entirely "true volunteers."

#### D. Predicted Quantity and Quality of Volunteers in the Absence of a Draft

The AFQT data presented in TABLE 12 indicates that applicant quality declines as draft pressure decreases to zero. The hypothesis that the distribution of quality in the present applicant population does not differ from the distribution expected in the absence of a draft can be rejected with 99.9% confidence, using a chi-square test. Based on the negative relationship between mental

aptitude and percentage of true volunteers observed in the data, the alternative hypothesis that applicant quality will decline in the absence of a draft can be accepted.

The applicant population meeting minimum mental aptitude requirements under present standards will be defined as the applicants in mental Categories I-III. In all four AQE areas the majority of Category IV individuals would not be expected to achieve the minimum AQE scores required for enlistment. Also, during the past five years Category IV individuals have been recruited under a separate quota as part of a special DOD program.<sup>63</sup> Due to the present unacceptability of much of the Category IV mental group and the special conditions influencing their enlistment, the groups considered as eligible for enlistment were restricted to Categories I-III.

The percentage of Category I-III applicants found to be true volunteers agreed closely with the estimate

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<sup>63</sup>The program, initially known as "Project 1,000,000," instructed each of the services to enlist a specified number of Category IV individuals. The program was designed to evaluate the ability of individuals in this mental category to adequately perform tasks normally assigned to enlisted members of the armed forces.

obtained in the 1968 survey. The survey found that 58.2% of Air Force first term enlisted personnel would not have enlisted in the absence of a draft, implying that 41.8% were true volunteers. The zero-draft model estimates contained in TABLE 13 indicate that 46.7% of the Category I-III applicants were true volunteers. Once again, the two figures are not completely comparable because the survey data examines first term enlistees while the model was applied to applicants. However, since the Air Force probably "creams" the applicant group to some degree and since applicant quality has been found to be inversely related to percentage of true volunteers, the percentage of true volunteers in the group actually enlisted from the applicant population would be expected to consist of less than 46.7% true volunteers. The estimated decrease in voluntary enlistments in the absence of a draft is thus comparable with the estimates derived through the survey method. The estimated decline is substantially higher than that estimated in most studies using the observation method, however. The results obtained here contradicted both the small proportional applicant quantity decrease estimated by Cook and White and the contention that the distribution

of applicant quality will be unaffected by the elimination of draft calls. The findings support the enlistment quantity decreases found in the DOD surveys and the decrease in applicant quality in the absence of draft pressure observed by Vitola and Valentine.

Because Air Force manpower requirements are not homogeneous, the process of determining the Air Force's ability to meet its manpower requirements consists of comparing the supply of and the demand for manpower at each quality level. Even though the number of qualified applicants for enlistment exceeds requirements, the distribution of mental aptitude within the eligible applicant group may prevent filling some quotas for individuals with high mental aptitudes. In a zero draft environment, TABLE 13 indicates that the eligible population (Categories I-III) will make up 76.3% of the total applicant group. Mental aptitudes within the eligible population will be distributed as follows:

Category I	Category II	Category III
11.0%	41.9%	47.1%

If aptitude requirements are reduced to allow all Category IV applicants to enlist, eligible applicants will make up

99% of the applicant group. The distribution of mental aptitudes among eligible applicants will be:

Category I	Category II	Category III	Category IV
8.5	32.3	36.3	22.9

By comparing the quality distribution existing in the applicant population with the Air Force's requirements for manpower, the size of the applicant population necessary to fulfill these requirements at all quality levels may be determined. Having found the areas in which manpower shortages are expected to occur, the aptitude quotas which constrain the size of the required applicant population can be identified. These in turn serve as the basis for suggesting the nature of additional incentives required to fill existing requirements in a zero-draft environment and as a means of identifying the existing requirements most in need of reevaluation. The following chapter will determine the Air Force's present manpower requirements by mental category and compare these requirements to the mental aptitude distributions expected if the draft is reduced to zero. The outcome of this comparison will be the basis for the policy recommendations contained in the concluding chapter.

**Chapter V - A Comparison of USAF Manpower Requirements with the Quantity and Quality of Volunteers in the Absence of a Draft**

The previous chapter describes the distribution of mental aptitude within the applicant group expected to enlist in the absence of a draft. In this chapter, the basis for manpower requirements will be described, current USAF enlisted manpower requirements presented, and a comparison made between present requirements and the expected applicant population in the absence of a draft.

**A. The Basis for Manpower Quality Requirements**

John A. Sullivan, in an article dealing with the mental quality requirements of the armed services, presents four arguments used by the services to justify the

need for high quality enlistees:<sup>64</sup>

- a. Modern military technology: The application of new military technology has required more high-mental group inputs.
- b. Cheaper training: Training is less costly with high-quality recruits. They learn faster and experience lower attrition rates in formal school training. That is, even if low-quality recruits are capable of assimilating technical knowledge, the costs of training them are high.
- c. Less disciplinary problems: Recruits with lower mental capabilities are more likely to be involved in serious disciplinary problems requiring court-martials, larger compliments of military police, and additional administrative costs. Hence, by rejecting the low quality recruits, the Services can reduce the cost of maintaining discipline.
- d. Staffing non-commissioned officer billets: Lower quality recruits are less likely to be eligible for reenlistment or promotion. Therefore, in order to fill the advanced pay grade positions the Services must inject a larger proportion of higher-quality individuals into the pipeline at the recruit level.

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<sup>64</sup> John A. Sullivan, "Qualitative Requirements of the Armed Services," in Studies prepared for the President's Commission on an All-Volunteer Force... p. I-2-2.

Since this paper takes Air Force requirements as given, the validity of the above arguments is not a consideration here. What is important to note is that in each of the four areas described above, quality increases are perceived as being associated either with increased effectiveness or decreased cost. Under these conditions, the armed services would find it to their benefit to maximize quality among the individuals they enlist, subject to the constraint imposed by the supply of applicants. Thus, Sullivan maintains that the quality "requirements" of the armed services are used to equilibrate the demand for and the supply of military manpower at a given moment in time rather than to meet some minimum limits imposed by the nature of the task performed.<sup>65</sup>

#### B. Determining USAF Quality Requirements

Sullivan's contention that the armed services use quality requirements to equalize manpower supply and

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<sup>65</sup> Ibid., p.I-2-16.

demand is similar to Cook and White's "creaming" hypothesis discussed in Chapter II. However, since it implies that the services always select the best applicants available at a given time, Cook and White's "creaming" process implies an immediate adjustment to changes in quality and quantity of applicants available for enlistment. The adjustment of minimum requirements to reflect changing supply and demand as suggested by Sullivan involves a considerable time lag between the change in supply or demand and the resulting shift in requirements. Changes in requirements therefore occur as the result of chronic imbalances in supply and demand rather than as the result of short-term fluctuations, which would produce enlistee quality fluctuations under Cook and White's "creaming" hypothesis.

Interviews with individuals responsible for establishing USAF quality requirements appear to bear out Sullivan's hypothesis that quality requirements are used as a long-run means of balancing manpower supply with the service's requirements for additional enlistees. The Air Force states its manpower requirements in terms of minimum AQE area scores required for entry into particular technical training courses. Since the only way to enter a

particular Air Force occupational area is through the technical school for that particular job, technical school requirements in effect specify the minimum AQE score required to enter each area. Technical school requirements are stated in terms of a minimum score in a particular AQE area (although alternative scores in other areas are sometimes specified).<sup>66</sup> To insure that the distribution of AQE scores held by enlistees matches the scores required to enter the technical school class starting during a particular period, the USAF Air Training Command informs the USAF Recruiting Service of the number of individuals required at each percentile level in each of the four AQE areas. These requirements are translated into the recruiting quotas discussed in Chapter IV.

The distribution of enlisted mental quality scores required to fill technical school minimums is determined by the office of the Air Training Command's Director of Student Personnel. This office also reviews any requests

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<sup>66</sup>Present minimum AQE scores ("selector AQE's") required for entry into each USAF technical school course are contained in Air Force Manual 50-5, USAF Formal School Catalog, Department of the Air Force, July, 1970.

for changes in minimum requirements for each technical school. Since higher mental quality individuals are easier to train (Sullivan's second point), the director of each technical school has a strong incentive to establish the highest aptitude minimums possible for the courses under his direction. However, the number of high quality applicants available to USAF recruiters is limited. The task of the Director of Student Personnel is essentially to balance the open-ended demand for increases in minimum quality requirements from the technical schools with the available supply of applicants at each quality level. When a technical school director submits a proposed increase in the selector AQE for that technical school, the Director of Student Personnel discusses the proposed increase with the USAF Recruiting Service to determine if the additional higher-quality applicants are available. If the higher quality applicants are available, the requested increase in the selector AQE minimum is usually approved.<sup>67</sup>

Selector AQE minimums are thus influenced by the

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<sup>67</sup> Interview, Author with Lt. Col. J.C. Denton (Director of Airman Students, Air Training Command), February 23, 1970.

supply situation which the Air Force faces at a given time. "Requirements," as used in this context, do not refer to the minimum distribution of mental aptitudes required to perform the Air Force's mission but rather to the distribution of mental aptitudes the Air Force perceives it can attract in the current environment.

Even the distribution of selector AQE's cannot be taken as the Air Force's true "requirement" for enlistee quality, however. Selector AQE's are seen as the minimum requirement for entry into a technical school. To provide future supervisory personnel, (Sullivan's fourth point), a distribution of mental aptitudes should be included in each technical school which insures that each individual possesses the minimum requirement for entry and some individuals exceed the entry requirement by a considerable degree. For example, the Air Force desires that the group entering a school with a general 40 minimum should include a substantial number of individuals with general scores above 40. The only statement of Air Force manpower quality requirements encountered by this author was that the Air Force wishes to maintain its present distribution of mental aptitude within the

enlistee population.<sup>68</sup> Although it would be difficult to defend this as a valid statement of mission requirements, it is the only quantifiable statement of requirements available. This paper will take it as given and discuss the implications of maintaining this requirement in the absence of a draft.

### C. The Present Distribution of Mental Aptitude Among Air Force Enlistees

One of the limitations of the lottery method is that it can be used only for the portion of the force with lottery numbers. The distribution of quality available in the absence of a draft estimated by this method thus applies only to one segment of the expected enlistee distribution. To compare this distribution with requirements, the corresponding portion of the present enlistee population (which will be taken as the USAF's manpower requirement) must be defined. The distribution of aptitude for individ-

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<sup>68</sup>Ibid.

uals with lottery numbers within the present enlistee population can be determined from Vitola and Valentine's data. If only the first three mental categories are considered, the percentage distribution is:<sup>69</sup>

Category I	Category II	Category III
11.4%	47.3%	41.5%

Including present Category IV enlistments (which are determined by DOD requirements) as part of the present population results in the following distribution:<sup>70</sup>

Category I	Category II	Category III	Category IV
9.5	39.3	34.5	16.7

Since the current distribution of enlistee mental aptitudes will be used as a statement of USAF manpower quality requirements, the above two distributions represent the current best estimate of manpower quality requirements. They can be compared to the distributions of mental aptitude

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<sup>69</sup>Percentages calculated from Vitola and Valentine, p.5.

<sup>70</sup>Ibid., p.5.

available in an all-volunteer environment to determine the Air Force's ability to meet its quantity and quality requirements in the absence of a draft.

**D. Comparing Available Quantity and Quality to USAF Requirements**

Chapter IV and earlier sections of this chapter have established the distribution of mental aptitude expected to be available to and required by the Air Force in the absence of a draft. This section will examine the relationship between available applicants and requirements and discuss some of the implications of the results of this comparison.

If the Air Force chooses to meet all its quality requirements with Mental Category I-III individuals, the distribution of available and required quality (as developed in Chapter IV and in the preceding section) is:

	Category I	Category II	Category III
Required	11.4%	47.3%	41.5%
Available	11.0%	41.9%	47.1%

where the "available" population makes up 76.3% of the total (Categories I-V) applicant population. As can be seen by comparing these two distributions, the average quality level required is above the average quality available in the absence of a draft.

This relationship implies that the Air Force must attract an applicant population considerably larger than the size of the group it actually intends to enlist if it is to fulfill quality requirements at all levels. The exact excess of total applicants over total requirements can be determined for any mental category  $j$  using the following relationship:

$$A/E = (1/e_{jp})/(1/a_j) = \frac{a_j}{e_{jp}}$$

where  $A$  = number of applicants necessary to meet requirements in category  $j$

$E$  = number of enlistees required to fulfill category  $j$  requirements

$a_j$  = proportion of total requirement in category  $j$

$e_j$  = proportion of eligible applicants in category  $j$

$p$  = proportion of total applicant population eligible for enlistment

For example, substituting data for Category I enlistments into the above equation yields:

$$A/E_j = \frac{a_j}{e_j p} = \frac{.11}{(.114)(.763)} = 1.36 \text{ applicants per enlistee needed to fill Category I requirement}$$

The ratio of total applicants to total enlistees required to fulfill quality requirements at each level is:

	Applicants/Enlistee
Category I	1.36
Category II	1.46
Category III	1.15

Since Category II enlistments require a higher applicant/enlistee ratio than those in Category I, some Category II requirements would be filled by Category I applicants if the applicant pool was large enough to fulfill requirements at all quality levels.

A rough estimate of the ability of the Air Force to meet requirements at all aptitude levels can be made by comparing the applicant population expected if the draft had been eliminated in 1970 with the requirements for

manpower in an all-volunteer force. Quantity requirements were based on the estimates of the President's Commission on an All-Volunteer Force. The Commission estimated that the proportion of the Air Force enlisted force requiring replacement each year in an all-volunteer force (turn-over rate) would be .152.<sup>71</sup> Target equilibrium enlisted strengths for the Air Force ranged between 471,200 and 628,200,<sup>72</sup> implying equilibrium annual manpower requirements of between 71,600 and 95,500 men, with the same proportion of enlistees at each mental aptitude level as presently exists in the enlistee population. Approximately 140,000 applications for enlistment were received in 1970 (44,000 additional 1970 applications arrived at the Document Depository after the sample used in this study was taken), of which 51.5% were "true volunteers" (from Chapter III). The estimated number of applicants who would have applied for enlistment in 1970 in the absence of draft pressure is therefore about 70,000 men, with mental aptitudes distributed as they are expected to be in the absence of a draft.

Manpower requirements were compared with the applicant population expected in the absence of a draft to determine

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<sup>71</sup> Report of the President's Commission on an All-Volunteer Armed Force..., p.185.

<sup>72</sup> Ibid., p.182.

If shortages exist at any mental category level. The results of this comparison are contained in TABLE 14.

TABLE 14

Percentage Increase in Applicants Expected  
in the Absence of a Draft in a  
Specified Mental Category to  
Meet Manpower Requirements in that Mental Category  
(Categories I-III)

Manpower Requirement (1000's)	Mental Categories		
	I	II	III
71.6	38.93%	51.33%	18.12%
95.5	85.31%	101.85%	57.55%

Manpower deficits occur in all mental categories, even at the lowest force levels considered by the President's Commission on an All-Volunteer Force. Deficits in Categories I and II are proportionately higher than the deficits experienced in Mental Category III.

One possible solution to the above deficits might be a reduction in the Air Force's quality requirements. Instead of filling all requirements with individuals in Categories I-III, the Air Force might elect to continue enlisting the same proportion of Category IV enlistees as is presently required by the Department of Defense.

This policy would result in the following distributions of requirements and available applicants:

	Cat. I	Cat. II	Cat. III	Cat. IV
Required	9.5%	39.3%	34.5%	16.7%
Available	8.5%	32.3%	36.3%	22.9%

99% of the available applicants would be eligible for enlistment using these standards.

Using the methods developed above, the ratio of total applicants to total requirements necessary to meet the Air Force's demand for manpower in each mental category can be determined as:

	Total Applicants/Total Requirements
Category I	1.13
Category II	1.21
Category III	.96
Category IV	.74

The increases in each mental category necessary to sustain the force levels described by the President's Commission on an All-Volunteer Force are contained in TABLE 15.

TABLE 15

Percentage Increase in Applicants  
 in a Specified Mental Category  
 Necessary to Meet Manpower Requirements  
 in that Mental Category  
 (Categories I-IV)  
 (Negative percentages indicate surplus applicants)

Manpower Requirements (1000's)	Mental Category			
	I	II	III	IV
71.6	15.47%	25.71%	-1.8%	-24.65%
95.5	54.02%	67.67%	30.97%	.50%

By lowering quality standards, the Air Force would substantially reduce the shortages experienced at each quality level in an all-volunteer force. In fact at the lowest force level considered a surplus of Category III and Category IV applicants would exist without additional inducements.

In most probable scenarios, however, additional inducements would be necessary to fulfill Air Force manpower requirements in the absence of a draft. As can be seen from TABLE 14 and TABLE 15, the proportional increases required in Mental Categories I and II are much larger than the increases required in Mental Categories III and

IV. This implies that the use of general military pay raises to eliminate manpower shortages will be efficient only if the supply of applicants with high mental aptitudes is much more elastic than the supply of applicants with low mental aptitudes. Unless this large difference in elasticities exists, pay raises sufficient to fill requirements in higher mental categories will produce an excess supply of applicants with lower mental aptitudes. Under these conditions, it would be less costly to meet manpower requirements by offering differential incentives to individuals with high mental aptitudes rather than by raising military pay for all enlistees.

## Chapter VI - Summary and Conclusion

### A. Summarization of Findings

As described in the introduction, the basic study question in this paper was subdivided into three subsidiary questions.

The first subsidiary question concerned the relationship between applicant draft lottery numbers and the quantity and quality of current applicants. A theoretical model of enlistment behavior was developed as a means of arriving at an initial hypothesis about the nature of this relationship. Based on this model, it was hypothesized that applicants for enlistment would decline if the probability of being drafted was decreased. Since an individual's probability of being drafted is inversely related to his position in the present draft lottery sequence, it was further hypothesized that more low sequence number individuals would apply for enlistment than individuals with numbers high in the lottery sequence.

The data observed in this study confirmed the a priori expectation that individuals who were high in the order of call (unlikely to be drafted) enlisted in much smaller numbers than individuals who were low in the order of call. Above a certain point, referred to as the "critical (lottery number) group" in this study, position in the lottery sequence had no effect on the number of individuals who applied for enlistment from each lottery number group. The interpretation placed on these findings was that if an individual held a lottery number above those assigned to the "critical group" he had a perceived probability of being drafted equal to zero. A higher position in the lottery sequence could cause no further decrease in perceived probability of being drafted, and therefore caused no further reductions in the number of individuals applying from a particular lottery number group.

The identification of a group with a perceived probability of being drafted equal to zero served as the basis for answering the second subsidiary question presented in the introduction. Since a portion of the individuals under the lottery system are presently certain they will not be drafted, it can be assumed that if draft calls were reduced to zero the rest of the potential applicant

population would respond in a similar manner. Based on this assumption, the applicant population expected in the absence of a draft can be estimated by multiplying the number of lottery number groups by the average number of applicants currently received from groups above the critical group in the lottery sequence. The applicant population expected in the absence of a draft can be divided by the current applicant population to determine the percentage of current applicants who would apply for enlistment if the draft is eliminated. Using the 15% random sample of 1970 applicants considered in this study, it was estimated that 51.5% of the present applicant population would have enlisted in the absence of a draft. To determine the effect of eliminating the draft on applicant quality (as measured by mental aptitude), the technique described above was applied to aptitude subgroups within the sample population. It was found that the percentage decrease expected for high aptitude applicants was about twice the percentage increase expected for individuals in the lowest mental aptitude category. In almost every case considered, the percentage decrease in applicants anticipated in the absence of a draft increased as groups with higher levels of mental aptitude or education were

considered (see TABLES 5-9).

Having determined the quantity and quality of applicants available for Air Force enlistment in the absence of a draft as required by subsidiary question two, the Air Force's stated requirements for manpower were determined and compared to the expected applicant population. This comparison indicates the Air Force's ability to meet its manpower quantity and quality requirements if draft calls are reduced to zero, which provides the response to the third and final subsidiary question. Manpower quantity requirements were varied over the range required to support the force sizes contained in the Report of the President's Commission of an All-Volunteer Force. Even at the lowest force level anticipated by the Commission, shortages were experienced in the two highest mental aptitude categories. At higher force levels, shortages were found in all categories. In every case, the percentage increases required to fulfill manpower requirements in the two highest aptitude categories were at least twice the increases required in lower mental categories. Since the average mental aptitude required was substantially above the average aptitude available in the absence of a draft, the quantity of applicants would have to exceed

requirements by a considerable amount (48%) to meet requirements at all aptitude levels.

#### B. Study Limitations

In considering the findings described above, several limitations existing in the procedure used must be enumerated. First, since the method used can only be applied to individuals with lottery numbers, the study was limited to the portion of the applicant population with numbers - males who were over nineteen before the cut off dates for the 1970 and 1971 lottery pools. By comparing the proportion of requirements presently filled by applicants holding lottery numbers with the expected applicant population derived in this study, it is implicitly assumed that the rest of the applicant population (females and males under 19) will exactly fill the remaining manpower requirements. To the extent that this assumption is false, the comparison made between applicants and requirements is invalid as a statement of the Air Force's over-all ability to meet its requirements. It is probable that inclusion of the rest of applicant population would reduce both the average quality required by and available to the Air Force.

A second limitation resulting from the use of lottery data stems from the use of 1970 data in this study. This was the first year of experience under the lottery system and in many ways (discussed in Appendix A) it was not a typical example of following years. Since it was a transition year to the new system, it included all draft-eligible males ages 19-26 rather than the 19 year old group to be considered in subsequent years. (Some individuals over 19 will be considered in subsequent years due to the college deferment program. However, the over-19 group will not be as large in proportion as during the transition year). Also, since 1970 was the first year under the new system, greater uncertainty about the working of the lottery system probably existed among draft-eligible individuals than will exist in future years.

The relationship between lottery numbers and number of applicants observed in this paper assumes that difference in applicant response is based solely on different perceived probabilities of being drafted. It expresses applicants for enlistment as a function of probability of being drafted. However, as demonstrated in the discussion of the theoretical model, other factors such as relative military pay, civilian unemployment rates and

non-monetary returns from various forms of employment also influence enlistment applications. The results obtained in this study therefore indicate how the 1970 applicant population would have behaved in the absence of a draft. The conclusions reached regarding the behavior of the 1970 population can be used to forecast future enlistments in the absence of a draft only to the extent that other factors influencing enlistment remain unchanged.

Finally, the conclusions reached regarding the Air Force's ability to meet its stated requirements are valid only if these stated requirements really represent the minimum manpower quality and quantity necessary to perform the Air Force's mission. Given the conclusion reached in Chapter V that quality "requirements" are largely a function of current supply and demand conditions, it is doubtful that the present statement of requirements is valid. It has been adopted here only because no other alternative statement of manpower quality requirements presently exists.

### C. Policy Implications

The policies required to implement an all-volunteer armed force depend on the size and nature of the manpower deficit the services would sustain in the absence of a draft and the responsiveness of potential applicants to changes in relative military compensation. This study addresses itself to the expected deficit in the absence of a draft. It therefore cannot be used to predict the amount of additional incentives necessary to meet requirements. However, the nature of the deficits observed does provide an indication of the type of incentives required.

The deficits experienced at high mental aptitude levels (as a percentage of the available population) were substantially higher than the percentage increases needed to fill requirements at lower mental aptitude levels. Unless high aptitude individuals are much more responsive to monetary incentives than low aptitude individuals, this suggests that a pay raise sufficient to meet requirements at higher aptitude levels will result in an over-supply at low aptitude levels. Under these conditions, differential incentives which provide more compensation at high

aptitude levels would allow the Air Force to fulfill its manpower requirements more efficiently than through the use of a general pay raise. Differential incentives could take the form of "proficiency pay" for skills requiring mental aptitudes or an enlistment bonus for individuals filling high mental aptitude enlistment quotas.

Since the price elasticity of military manpower supply (the sensitivity of enlistments to changes in military pay) can be objectively measured, most studies of an all-volunteer force have focused on pay increases as a means of attracting sufficient manpower. The basic methodology adopted by the Gates Commission (as described in Chapter I) assumes that manpower deficits will be removed by increasing military pay. In terms of the theoretical model developed in Chapter II, this implies that  $M_1$  will be increased until  $M_1 \geq M_1^*$  for a group within the population sufficient to meet quantity and quality requirements of the armed forces.

However, a considerable body of information exists which suggests that additional monetary incentives may be a highly inefficient method of attracting and retaining additional manpower in an all-volunteer force. Once both military and civilian pay have reached levels suffi-

ient to provide a comfortable standard of living, non-monetary factors such as job satisfaction and status begin to dominate an individual's career choice.<sup>73</sup> Instead of increasing  $M_1$ , the Air Force could attempt to influence the  $d_1$ 's (net non-monetary preference for military as opposed to civilian employment) held by the potential enlistee group in such a way that  $M_1^*$  was reduced for most of the individuals in the group. This would increase the number of enlistment applications available at a given level of military pay,  $M_1$ , and reduce the requirement for new recruits by improving retention rates for those individuals already in the Air Force.

One step toward increasing job satisfaction in the military services would be a reduction in the number of jobs - both in terms of positions and classifications. The cost of a unit of labor to the military in an all-volunteer force will probably be at least as high as a similar unit of labor in the civilian economy. However, the draft presently allows the military to procure man-

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<sup>73</sup> Findings supporting this contention are contained in: Officer Motivation Study "New View," Vol. I-II. Washington, D.C.: USAF Director of Studies and Analysis, 1966.

power at rates substantially below those existing in the civilian market. As a result, many tasks performed by the military use a far more labor-intensive capital-labor mix than similar tasks in the civilian economy.<sup>74</sup> As the military transitions to an all-volunteer force, it should therefore begin substituting capital for labor in many areas and using those manpower resources still required to a more intensive degree.

The result should be a reduction in the number of individuals required by the military and an expansion of the breadth of each task performed by those individuals remaining in the military. In addition to being the most efficient method of utilizing manpower in an all-volunteer force, job expansion should result in increased job satisfaction. The decrease in over-all quantity requirements resulting from this program will also allow the services to be more selective in enlisting the individuals they still require. This will produce a smaller, higher quality

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<sup>74</sup> See for example: Herman L. Gilster, and Lloyd Woodman, Jr., An Investigation into the Use of Labor and Capital for Aircraft Maintenance in the Military and Commercial Sectors, TR-69-2. USAF Academy, Colorado: Department of Economics, USAF Academy, 1969.

force than would result from continuation of the present level of inputs.

Since the military will be competing with civilian employers on an equal footing if the draft is eliminated, military personnel management policies should become more compatible with the civilian economy. At present, the military manpower system is largely closed to cross-flows from the civilian sector at all but the lowest grades in the system. By allowing individuals who already have skills needed by the military to enter at grades commensurate with their abilities, a larger pool of potential enlistees would be made available for service. In addition, increased cross-flows into higher grades would increase the flow of new ideas and attitudes into higher layers of the military management system.

While difficult to quantify, the improvements in enlistments, retention, and manpower productivity resulting from reductions in the non-monetary costs of military service may be greater than improvements resulting from increases in military pay. The monetary returns from military service must be sufficient to meet physical needs, but they will not fulfill the higher level needs being felt by more and more individuals in an increasingly

affluent society.

**D. Suggestions for Future Study**

Suggestions for future study fall into two major areas. The first area concerns the removal of some of the limitations discussed in section B. The second area for additional study involves the application of the techniques developed in this study to other military supply problems.

The proportion of the present applicant population not possessing a lottery number consists primarily of women and males under 19. Under the lottery system, all males who would not enlist in the absence of a draft have a strong incentive to delay enlistment until after they have been assigned a lottery number, which may effectively exempt them from induction. Therefore, applicants 18 years old and younger could be expected to be less sensitive to elimination of the draft. Likewise, female applicants would probably be unaffected by elimination of the draft.

A response by these two groups to elimination of the

draft which differs substantially from the expected behavior of the group with lottery numbers could modify the conclusions reached in this paper. Since the lottery method could not be used, a study of female applicants or males under 19 would have to use either the observation method or the survey method. A survey of applicants would be difficult to administer, and there are several problems associated with the use of the observation method to measure the effects of eliminating the draft, as discussed in Chapter II. However, these appear to be the only alternatives presently available.

The problems created by the transitional nature of the 1970 lottery will not be present in data from 1971 and subsequent years. Experience in subsequent years also serves as a means of confirming the estimates of the zero-draft population derived from the 1970 pool. For example, in the 1970 pool the highest number called was 195. For the 1972 pool, the highest number the Selective Service Administration expects to call is 150.<sup>75</sup> Since the draft could be expected to have a decreased effect on enlistment decisions in the 1972 pool, the per-

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<sup>75</sup>Washington Post (August 6, 1971), p.1.

centage of "true volunteers" should be higher in 1972 than those found in the 1970 lottery pool. Finally, studies of experience under the lottery system in later years will reflect any changes in the other independent variables affecting applicants for enlistment in the Air Force.

The requirement for mental aptitude stated by the Air Force does not reflect the actual minimums required to perform the Air Force's mission. At best, aptitude requirements are used to insure success in technical school, which may not be a necessary prerequisite to success on the job. In an environment where high quality enlistees will mean increased recruiting and compensation costs for the armed services, requirements for these individuals must be carefully validated in terms of actual job performance requirements. The trade-off between quality and recruiting costs, training costs and other factors which affect the best "mix" of aptitudes in an all-volunteer environment should also be examined.

Associated with the need for additional study of the Air Force's manpower quality requirements is a re-examination of the USAF testing programs used in selecting enlistees. The Air Force presently classifies applicants according

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Associated with the need for additional study of the Air Force's manpower quality requirements is a re-examination of the USAF testing programs used in selecting enlistees. The Air Force presently classifies applicants according

to their four AQE scores and their AFQT score. The high correlation between all five of these indices suggests that they measure mostly the same thing. Assuming this is the case, it would be better to select applicants according to their score on one index. This would reduce the amount of testing at recruiting detachments and reduce the number of regular quotas a recruiter is required to fill from 12 (3 percentile quotas in each AQE area) to 3 (3 percentile quotas in the single aptitude selector index). The AQE could still be used for classification purposes in basic training.

The procedure used in this paper could be applied to any other group of applicants for enlistment. For example, in the Air Force ROTC cadets and applicants for entry into Officer Training School could be examined to determine the decrease in applicants for officer training in the absence of a draft. Since all applicants for officer training know their lottery numbers before they apply, the entire applicant population could be considered. Outside the military, lottery number distributions could be used to examine the effects of perceived probability of being drafted on civilian employment behavior. Individuals who were low in the order of call might show a preference for

particular types of employment different from those selected by individuals high in the order of call. Also, employers might show a preference for employees who were high in the order of call. By examining the distribution of lottery numbers held by employees in different industries, both of these areas could be explored.

#### Appendix A - Data File Development

Since this study will examine lottery numbers for Air Force enlistees, the data used in the study must meet several criteria. To determine an individual's lottery number, the year, month, and day of birth must be known. To influence an individual's enlistment decision, a lottery number must be assigned before the individual applied for enlistment. Thus, the date each individual applied for enlistment must also be known to determine which individuals had lottery numbers when they applied for enlistment. Finally, the sex of each applicant must be known, since lottery numbers are assigned only to males.

In addition to information required to determine lottery number, the data source must contain a measure of enlistee quality. "Quality" can be measured by aptitude test scores or educational level. However, since the Air Force states its quality requirements in terms of aptitude scores and since the primary purpose of this paper is to compare predicted enlistee quality and quantity

with requirements, the quality measure in the data source must be comparable with the aptitude measure used in stating requirements. Air Force requirements are stated in terms of Airmen Qualifying Examination (AQE) scores so the data source must contain AQE scores, or be convertible to a comparable aptitude index.

As stated in Chapter II, existing studies are usually limited to an examination of the enlistee population. The conclusions drawn through an examination of this data may not be valid for the population of applicants for enlistment, especially when the number of applicants consistently exceeds the enlistment quota. The Air Force has experienced this situation during most of the last decade. To allow conclusions to be drawn about changes in the applicant population the data base used in this paper should represent the group initially applying for enlistment, regardless of whether or not the individuals concerned finally entered the Air Force.

## A. Data Base Selection

Since applicant quality data is required to meet the requirements of this study, the USAF applicant testing program was examined to determine if the necessary information is available. Several different aptitude tests are used by the Air Force in its testing program, but some are not administered to all applicants.

An individual who is considering Air Force enlistment generally makes an initial inquiry through an Air Force recruiter. To determine if the individual is eligible to enlist, the recruiter will administer the Airman Qualifying Examination (AQE) to the applicant. The AQE is an aptitude test battery designed to predict relative ability to complete technical training. Test scores take the form of percentile rankings in each of four areas which in turn relate to ability in a particular type of Air Force job. The scores are normed on the distribution of talent expected in a wartime mobilization population.<sup>76</sup> The per-

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<sup>76</sup> H.L. Madden and W.B. Leeznar, Development and Standardization of Airman Qualifying Examination - 1964, PRI-TR-65-14. Lackland AFB, Texas: Personnel Research Laboratory (August, 1965), p.5. The test is normed against the 1960 12th grade male population.

centile range is broken into increments of five percent. Since the score associated with each increment indicates the percentage of the population scoring below that increment, the highest score on the test is 95 and the lowest is 0 (0 is scored as 01 to facilitate use of scores with data processing equipment).<sup>77</sup> Scores are stated in the form of four different indexes or area scores - mechanical, administrative, general, and electronic. Each of these four area scores can be used to predict an individual's ability to complete training in that area.

Since 1958, the Air Force has used AQE scores to selectively enlist individuals against AQE quotas. To enlist against a particular quota, an individual must possess an AQE area score equal to or above the score specified by the quota. (The method used to develop quotas is described in Chapter III). Prior to 1958, the only test used to screen potential recruits was the Armed Forces Qualifying Test (AFQT), which yields a single in-

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<sup>77</sup> Headquarters USAF Recruiting Service. Aptitude Testing in the United States Air Force. A report based on material prepared by the Personnel Research Laboratory, Lackland AFB, Texas. Wright-Patterson AFB, Ohio: Headquarters USAF Recruiting Service (October, 1962), p.3.

day of applicant quality. AFQT minimums were established for each service to insure that manpower quality was distributed equitably between the services, but no testing for classification purposes was done until basic training.<sup>78</sup> At the present time, however, this process has been reversed. An individual takes the AFQT only if he attains an acceptable score on the AQE. To qualify for enlistment, an applicant must qualify for an enlistment quota (a minimum AQE score specified by the Air Force) and then receive an acceptable AFQT score (specified by the Department of Defense).<sup>79</sup>

In addition to the AQE and the AFQT, one other test is used to measure applicant quality. The Armed Services Vocational Aptitude Battery (ASVAB) is administered to high school seniors desiring to take part in the testing program prior to their graduation. The scores from this test can be used in place of the four area scores from the AQE.<sup>80</sup> An individual who has completed the ASVAB

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<sup>78</sup>Ibid., p.17.

<sup>79</sup>Ibid., p.17.

<sup>80</sup>U.S., Department of the Air Force, Air Force Military Personnel Testing System, Air Force Manual 35-8. (December, 1969), p.10-1.

prior to enlistment may submit his scores to an Air Force recruiter in place of scores on the AQE. These scores are then entered into his record in place of the AQE area scores and he is enlisted against a recruiting quota based on his ASVAB scores.

The answer sheets for all three tests (AQE, AFQT, ASVAB) are shipped to the USAF Document Depository at Lackland AFB, Texas after they have been scored. Although identification information cannot be machine processed, all answer sheets completed within the last 8-10 years are available.

The AQE examination was selected for use in this study both because it contained all necessary data elements and because the population taking this examination is a close approximation of the true applicant population. The ASVAB is given to the entire senior class in many high schools participating in the program, so many of the individuals who take the test have no intention of enlisting in the armed forces. Furthermore, at the present time less than 10% of the high school population is being tested, with major differences in the percentage tested in various geographical regions.<sup>81</sup>

<sup>81</sup> Interview, Author with CMSgt. L.W. May, Hq USAF Recruiting Service, Randolph AFB, Texas (May 8, 1971).

The ASVAB is thus not a good representation of the applicant population or the total high school population. In the case of AFQT the population has already been screened using AQE scores, as previously described. Also, birth date is not included in the identifying information on the AFQT. The AQE, however, is taken by all individuals who initially apply for enlistment. The individuals taking the AQE therefore represent an un-screened group interested enough in Air Force enlistment to apply at a recruiting station.

Although a good representation of the applicant population, the AQE does contain some imperfections. Some individuals who take the AQE are merely interested in finding out what the Air Force will offer them. They are not truly "applicants" in that they would not be willing to commit themselves if offered the chance to enlist. Also, some individuals apply under their ASVAB scores and therefore do not take the AQE at all. In both of these cases, however the group involved is small<sup>82</sup> and there

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<sup>82</sup> Since over 75% of the AQE population considered in this paper eventually accepted enlistment in the Air Force, most individuals apparently entered with the intention of accepting enlistment if it was offered. As was previously mentioned, the ASVAB is administered to less than 10% of the present high school graduating class.

is no evidence that suggests it biases the group taking the AQE as an estimator of the true applicant population.

#### B. Sample Design and Selection

After AQE answer sheets are scored and the scores are recorded for use at each recruiting detachment, the graded answer sheets are shipped to the USAF Personnel Document Depository, operated by the USAF Human Resources Laboratory at Lackland AFB, Texas. The answer sheets are boxed at the Depository in the order in which they arrive, with approximately 3000 answer sheets per box. Since they are boxed in the order in which they are received, the answer sheets are stored in roughly chronological order.

The data for this paper were collected during the first week in December, 1970. At that time, the Depository contained 32 boxes of AQE answer sheets that had been completed since the first lottery drawing on December 1, 1969. The most recent answer sheets available were from October, 1970 (there is usually a six week delay between

the time an individual takes the AQE and the time the answer sheets arrive in the Depository). Assuming 3,000 records per box, the subject population was estimated to consist of 96,000 individual answer sheets.

Since identifying information on the forms was not machine processable, a random sample was drawn from the population. Forty-five clusters of ten answer sheets were drawn at evenly spaced measured intervals from each box of data, for a total sample of 14,200 records or 15% of the total population.<sup>83</sup> Data from the answer sheets were transcribed on coding forms and then transferred to punch cards.

#### C. Data File Creation

For each record in the sample, the following information was recorded:

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<sup>83</sup> Using a 15,000 record sample, small subgroups (1% of the total population) can be estimated  $\pm$  16% of their true value with 95% confidence. See William G. Cochran, Sampling Techniques. New York: John Wiley and Sons, 1963, p. 74.

Test Date (Yr-Mo-Dy)  
Years of Education  
Date of Birth (Yr-Mo-Dy)  
Sex  
Future Plans  
AQE Scores (Mechanical, Administrative,  
General, and Electronic)

"Future Plans" refers to a block included on the AQE answer sheet which allows an individual to express his intentions regarding Air Force enlistment. The responses obtained here are of doubtful validity, since even uncertain individuals will probably not wish to decrease the attention devoted to their application. However, the responses to this item were included in the sample data as a possible means of further screening "true" applicants for enlistment. The responses made were coded "1" if favorable to Air Force enlistment and "0" if unfavorable or if the item is left blank.

The sample card file was first run against an editing routine which eliminated records containing invalid data elements. Data elements not falling within the following bounds were eliminated:

Test Date: December 1, 1969 - December 1, 1970

Years of Education: Below 20

Date of Birth: more than 17 and less than 28 years from test date (required for enlistment)

Sex: M or F

Flans: 1 or 0

AQE Scores: each score must be 01 or a multiple of 5, 05-95.

In addition, each date was checked for validity (that is, errors like "February 30, 1970" were detected and eliminated). The editing process eliminated 433 records, or about 3% of the sample population. The majority of the eliminated records were for tests taken prior to December 1, 1969.

The edited card file was then used to create the data file used in this study. In addition to the data contained in the card file, the data file contains each applicant's draft lottery sequence number. The program used to create the data file determines whether each individual had been assigned a lottery number before applying for enlistment and looks up the lottery number for all who did.

Each individual's lottery number is based on his birth date. Year of birth determines which random sequence drawing applies to a particular individual, while the month and day of birth identifies the number in the sequence applying to the individual.

In addition to providing for random selection of qualified registrants, Public Law 91-124 reduced the period

of vulnerability to the draft from seven years to one year.<sup>84</sup> Before the passage of this law, an individual was vulnerable to the draft from age 18 to age 26, with the oldest registrants in the pool being selected first. After its passage, an individual would be considered for induction only during the calendar year beginning after his nineteen-thventh birthday, unless calls big enough to exhaust an entire year group became necessary. If this occurs, older individuals will be drafted. Any person who is deferred during his normal year of vulnerability will be included in the year group being considered when his deferment ends, using his original sequence number.

If the system as described above had been implemented in 1970, a group of individuals in their early 20's would have been skipped entirely, because they were too young to be drafted under the "oldest first" system and would have been too old to be considered under the new system. To ensure these men did not escape exposure, the 1970 random sequence included all individuals age 19-26 instead of only the nineteen years old group to be considered in

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<sup>84</sup> Selective Service Administration, Semi-Annual Report of the Director, July 1-December 31, 1969. Washington, D.C.: Government Printing Office, 1970, p.7.

subsequent sequence drawings.<sup>85</sup> The group to be considered in 1970 was thus not typical of the group to be considered in later years.

The group considered during 1970 was also affected by a change in deferment policy. Executive Order 11527, issued April 23, 1970, ended the granting of deferments for paternity, agriculture, or occupation.<sup>86</sup> This change in policy reduced the alternatives to military service available to individuals graduating in June, 1970, especially for higher quality individuals who were best able to compete for exempt employment.

The first lottery numbers were assigned on December 1, 1969 and applied to individuals born between January 1, 1944 and December 31, 1950.<sup>87</sup> The first draft calls under this sequence were made in January, 1970. Individuals

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<sup>85</sup> Selective Service Administration, Lottery, a lottery draft information pamphlet, Washington, D.C.: Government Printing Office, 1970, p.1.

<sup>86</sup> Selective Service Administration, Semi-Annual Report of the Director, January 1- June 30, 1970, Washington, D.C.: Government Printing Office, 1970, p.7.

<sup>87</sup> Selective Service Administration, Semi-Annual Report of the Director, July 1-December 31, 1969..., p.7.

with numbers at the beginning of the sequence thus had a month to decide between induction and enlistment. The second lottery sequence, which assigned numbers to persons born in 1951, was drawn on July 1, 1970.<sup>88</sup> Since individuals with numbers in this sequence would not be drafted until January, 1971 at the earliest, they had six months to seek out an alternative form of service before being drafted. Even though they were not currently subject to the draft, the probability of being drafted in the future, as indicated by their lottery numbers, undoubtedly influenced their enlistment decisions made after July 1, 1970. Pre-induction physicals were begun for persons with numbers 1-100 in the 1971 sequence during August, 1970,<sup>89</sup> further increasing the draft pressure perceived by this group. This paper assumes that an individual's lottery number influences his decision to enlist as soon it is assigned, even though no inductions are being made from his year group. For this reason, all individuals who had been assigned numbers before applying for enlistment were included in the sample population considered by

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<sup>88</sup> Selective Service Administration, Semi-Annual Report of the Director, July 1-December 31, 1970, Washington, D.C.: Government Printing Office, 1971, p.6.

<sup>89</sup> *Ibid.*, p.6.

this study.

The sample population having lottery numbers was defined as the group having a lottery number assigned before taking the AQE. To be included in this group, an individual had to be male and fall into one of the two following categories:

<u>Category</u>	<u>Birth Year</u>	<u>Test Date After</u>
I	1944-1950	December 1, 1969
II	1951	July 1, 1970

Category I individuals were assigned numbers (by month and day of birth) according to the sequence drawn on December 1, 1969. Category II individuals were assigned numbers drawn on July 1, 1970. The data file (created on magnetic tape) thus contained the following data elements for each of the 13,773<sup>90</sup> individuals in the sample:

Test Date (Yr-Mo-Dy)  
 Years of Education  
 Birth Date (Yr-Mo-Dy)  
 Lottery Number (if any)  
 Sex  
 Future Plans  
 AQE Scores

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<sup>90</sup> Some data items are blank on a small portion of the records in the sample. The sort program used in compiling the descriptive statistics contained in the next section ignores blank data items. The size of the sample population therefore appears to fluctuate slightly, depending on the data element on which the sort is run.

## D. Data File Description

A series of sorts were made on various elements of the data file to determine the characteristics of the sample as well as to provide a gross check on the validity of the data.

Since the model to be developed in the third chapter can be used only with individuals who have lottery sequence numbers, the proportion of individuals in the sample holding lottery numbers is of primary importance.

TABLE A1

## Sample Distribution by Sex and Lottery Number (Entire Sample)

Female	1684
Male	12083
With Numbers	7501
Without Numbers	4582
	1376?

If only the records for individuals who indicated they are interested in Air Force enlistment (Plans Code=1) are considered, the following distribution results:

TABLE A2

Sample Distribution for Individuals  
 Indicating Desire to Enlist,  
 by Sex and Lottery Number

Female		1134
Male		8625
With Numbers	5325	
Without Numbers	3300	
		9759

In both the total sample population and the portion of the sample population indicating an interest in Air Force enlistment, individuals with lottery numbers make up about 55% of the total. Therefore, based on their stated intentions, there does not appear to be a tendency for individuals with lottery numbers to have a stronger or weaker preference for enlistment than the rest of the sample.

Normally, applications for enlistment peak during June and July due to the large number of individuals leaving school at that time. The sample data was examined to determine if a similar pattern was observed.

TABLE A2  
 Distribution of Applicants During the Year,  
 by Sex and Lottery Status  
 (percentages of monthly totals also shown  
 for group with lottery numbers)

	Dec '69	Jan '70	Feb	Mar	Apr	May
<b>Males with Numbers</b>	80 (63%)	481 (59%)	432 (57%)	500 (46%)	744 (48%)	753 (52%)
<b>Males with- out Numbers</b>	32	317	270	469	632	578
<b>Females</b>	15	22	49	123	189	126
<b>Total</b>	127	820	751	1092	1565	1457
	June	July	Aug	Sept	Oct	Nov
<b>Males with Numbers</b>	759 (42%)	1036 (56%)	1078 (60%)	788 (63%)	457 (62%)	14 (70%)
<b>Males with- out Numbers</b>	869	667	577	378	225	3
<b>Females</b>	155	149	149	91	58	3
<b>Total</b>	1783	1852	1804	1257	740	20

The total number of applicants by month follows the expected pattern, with the exception of the December, 1969 subgroup, which is significantly smaller than any other monthly total. Since this portion of the sample was drawn from the oldest data in the population, the sampling process may have omitted some of the December, 1969 data during sample selection. This would result in the low monthly total observed above. November, 1970 is also understated since most answer sheets from that month had not yet reached the Depository when the sample was taken.

Another interesting facet of TABLE A3 is the manner in which the percentage of individuals with lottery numbers fluctuates over time. Beginning at 63% in December, 1969, the percentage of individuals with lottery numbers declined during the first half of the year. However, with the end of the school year, many individuals lost their educational deferments and in July the 1971 sequence was announced. As a result, the percentage of individuals with lottery numbers applying for enlistment increased to over 60% and did not fall below 56% for the rest of the period observed. This increase agrees with the experience of many draft boards in the Selective Service System during this period. Due to the increase in the group subject to the lottery

because of terminated educational deferments, and the resulting increase in individuals with low lottery numbers, some draft boards were actually calling individuals with higher sequence numbers in May, 1970 than they were calling in December, 1970.<sup>91</sup>

The effect of high school and college graduation on the distribution of years of education in the applicant group was also apparent in the sample data. Because most high school and college graduates make an enlistment decision immediately before or soon after graduation, enlistments from individuals in these three categories are concentrated between the months of April and August.

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<sup>91</sup> Selective Service Administration, Semi-Annual Report of the Director, July 1- December 31, 1970..., p.1.

TABLE A4  
Distribution of Years of Education by Month

	Dec '69	Jan '70	Feb	Mar	Apr	May
Below 11	3%	7%	6%	5%	5%	5%
11-12	60	65	65	68	66	63
13-14	27	21	20	19	19	19
15-16	9	7	8	8	10	12
Over 16	0	0	1	0	1	1
n	127	805	744	1087	1552	1445
	Jun	Jul	Aug	Sept	Oct	Nov
Below 11	5%	6%	5%	6%	8%	11%
11-12	65	72	73	73	74	68
13-14	16	13	14	16	13	16
15-16	13	8	7	6	5	5
Over 16	1	1	1	1	0	0
n	1773	1835	1794	1251	736	19

Many persons who are still in school initiate applications for enlistment during April and May, so the large increases observed in these months were for the most part applicants who wished to enter upon graduation in June. These individuals do pose a problem in interpreting the data, however, since some individuals do not count the year of school they are presently completing as a year of school, while others do include the current year as a year of education. This problem becomes particularly important if an estimate of high school or college graduates in the population is desired (that is, applicants with at least 12 and at least 16 years of education). This paper attempts to circumvent this problem by aggregating the 11 and 12 year groups and the 15 and 16 year groups. If used as measures of high school and college graduates respectively, these two groups will in fact overstate the number of graduates in the sample because they do include some individuals who in fact have only 11 or 15 years of education.

Examining the distribution of educational levels within the population reveals a heavy concentration of individuals with education beyond high school in the group with lottery numbers. As previously developed in

the discussion of the Vitola and Valentine paper, this is not surprising due to differences in age. However, the data does reinforce Vitola and Valentine's contention that the group not assigned lottery numbers is of substantially lower mental quality than the group assigned lottery numbers.

TABLE A5  
Years of Education by Sex and  
Lottery Status

		<u>Years of Education</u>					
		Below 11	11-12	13-14	15-16	Over 16	Total
Female	N	5	1467	180	15	0	1667
	%	.3	88.0	10.8	.9	0	100
Male with- out Lottery Number	N	420	3942	177	13	3	4552
	%	9.2	86.6	3.9	.3	.1	100
Male with Lottery Number	N	308	3911	1946	1180	106	7451
	%	4.1	52.5	26.1	15.8	1.4	100

180.

**Appendix B - Distribution of Lottery  
Numbers within each AQE Mental Aptitude  
Subgroup and Educational Subgroup**

Relative Number  
of Applicants

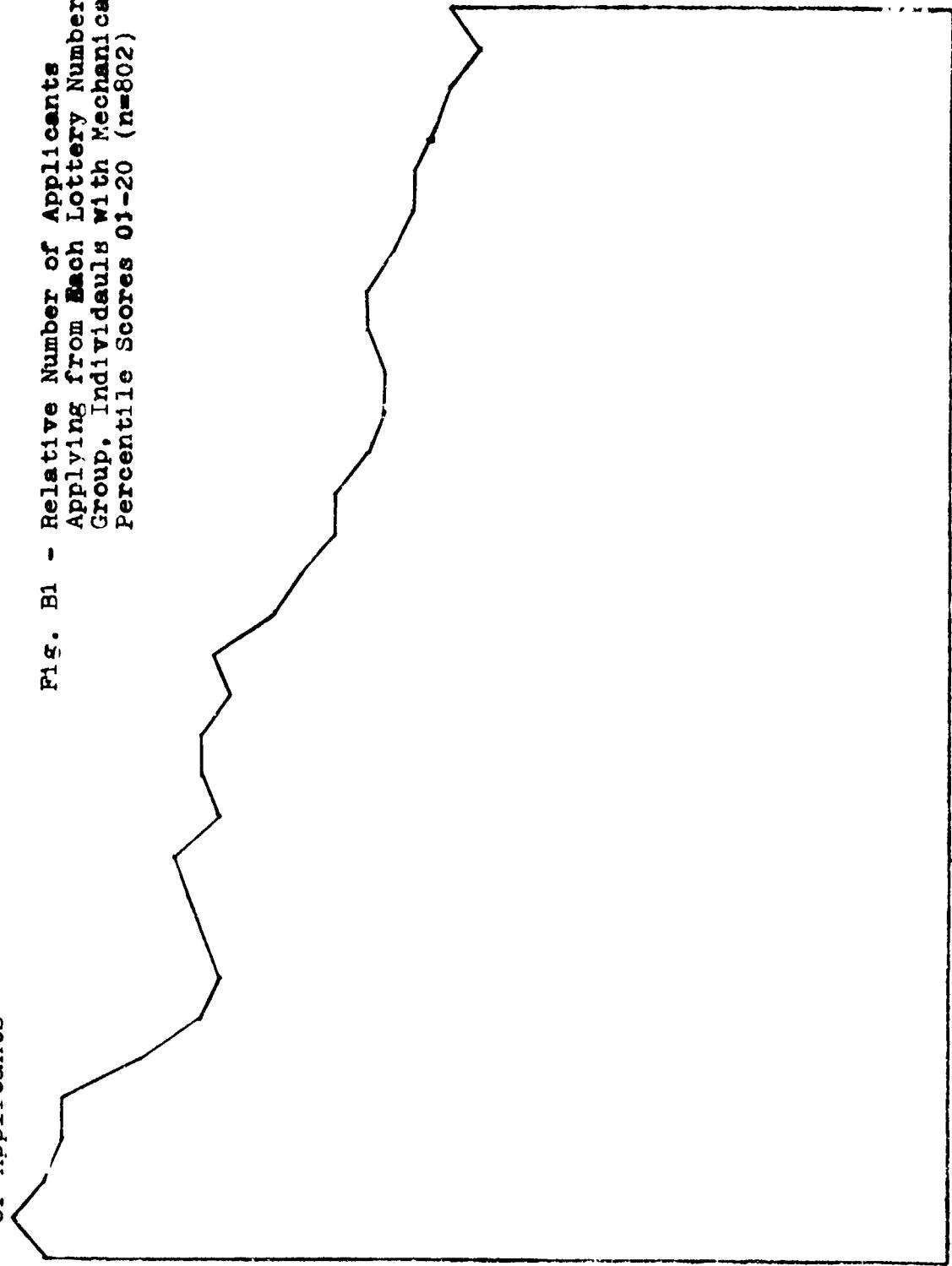
Fig. B1 - Relative Number of Applicants Applying from Each Lottery Number Group. Individuals With Mechanical Percentile Scores 01-20 (n=802)

181.

320  
Lottery  
Number

200

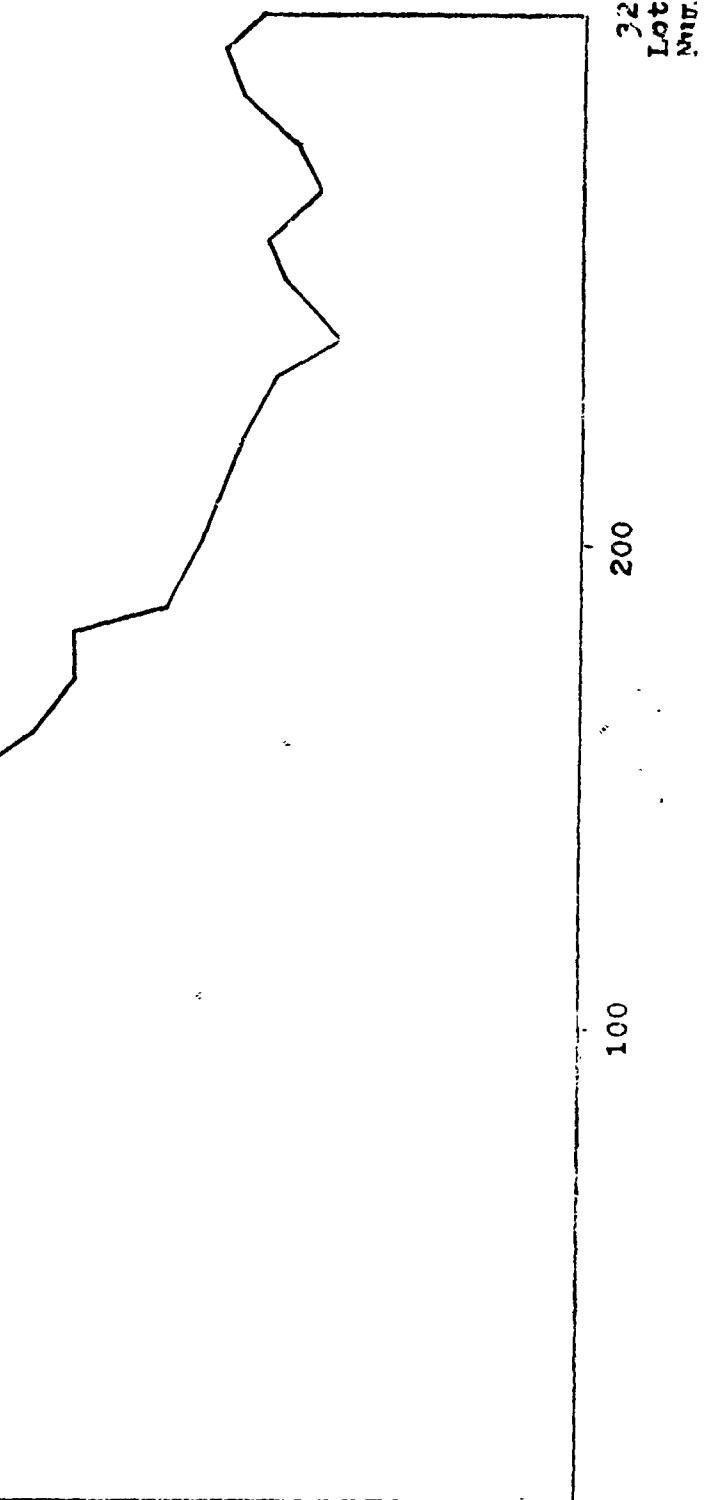
100



Relative Number  
of Applicants

Fig. B2 - Relative Number of Applicants  
Applying from Each Lottery Number  
Group, Individuals with Mechanical  
Percentile Scores 25-35 (n=805)

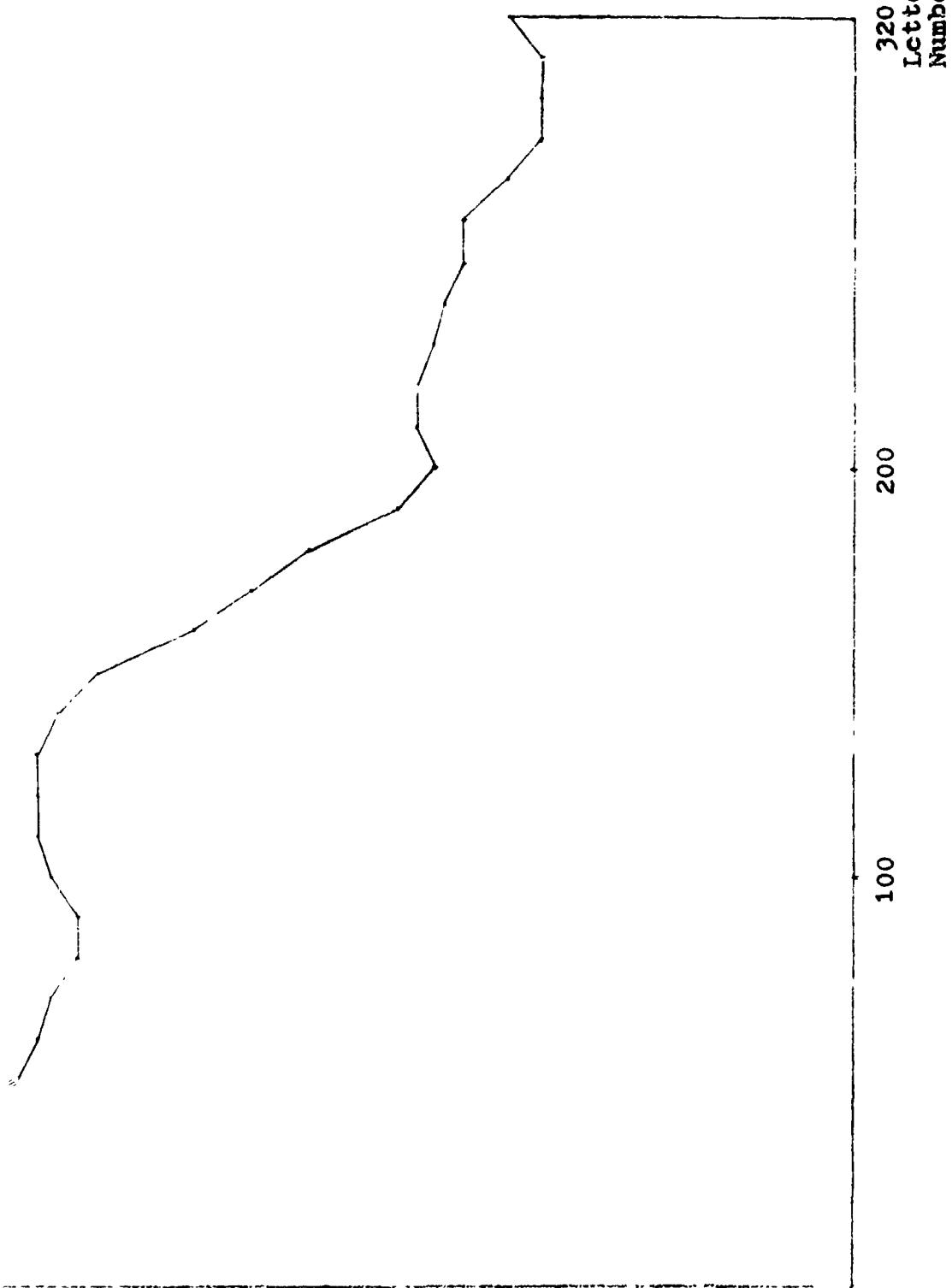
182.



Relative Number  
of Applicants

Fig. B3 - Relative Number of Applicants Applying from Each Lottery Number Group. Individuals with Mechanical Percentile Scores 40-55 ( $\mu=1920$ )

183.



320  
Lottery  
Number

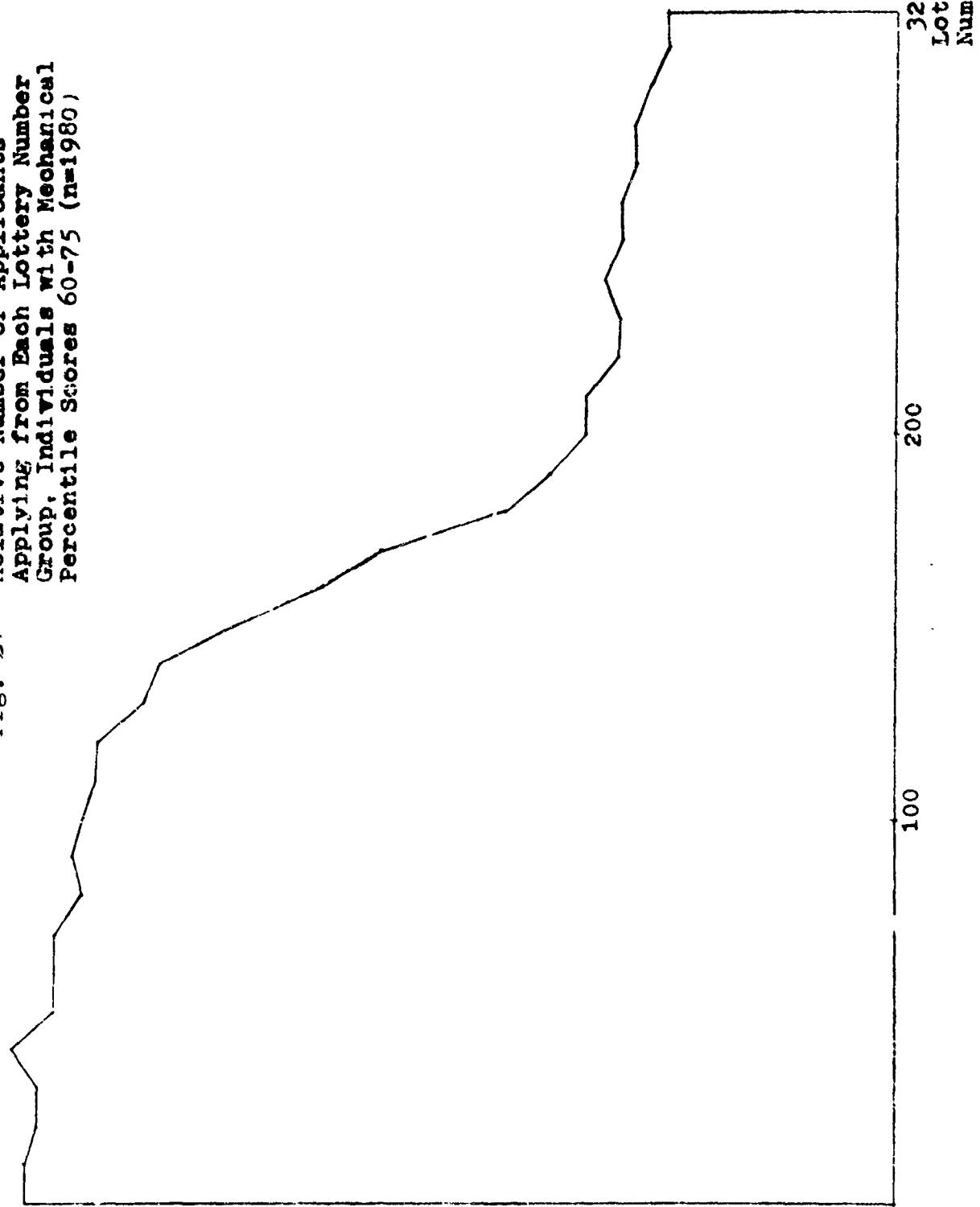
200

100

Relative Number  
of Applicants

Fig. B4 - Relative Number of Applicants  
Applying from Each Lottery Number  
Group, Individuals with Mechanical  
Percentile Scores 60-75 (n=1980)

184.



320  
Lottery  
Number

200

100

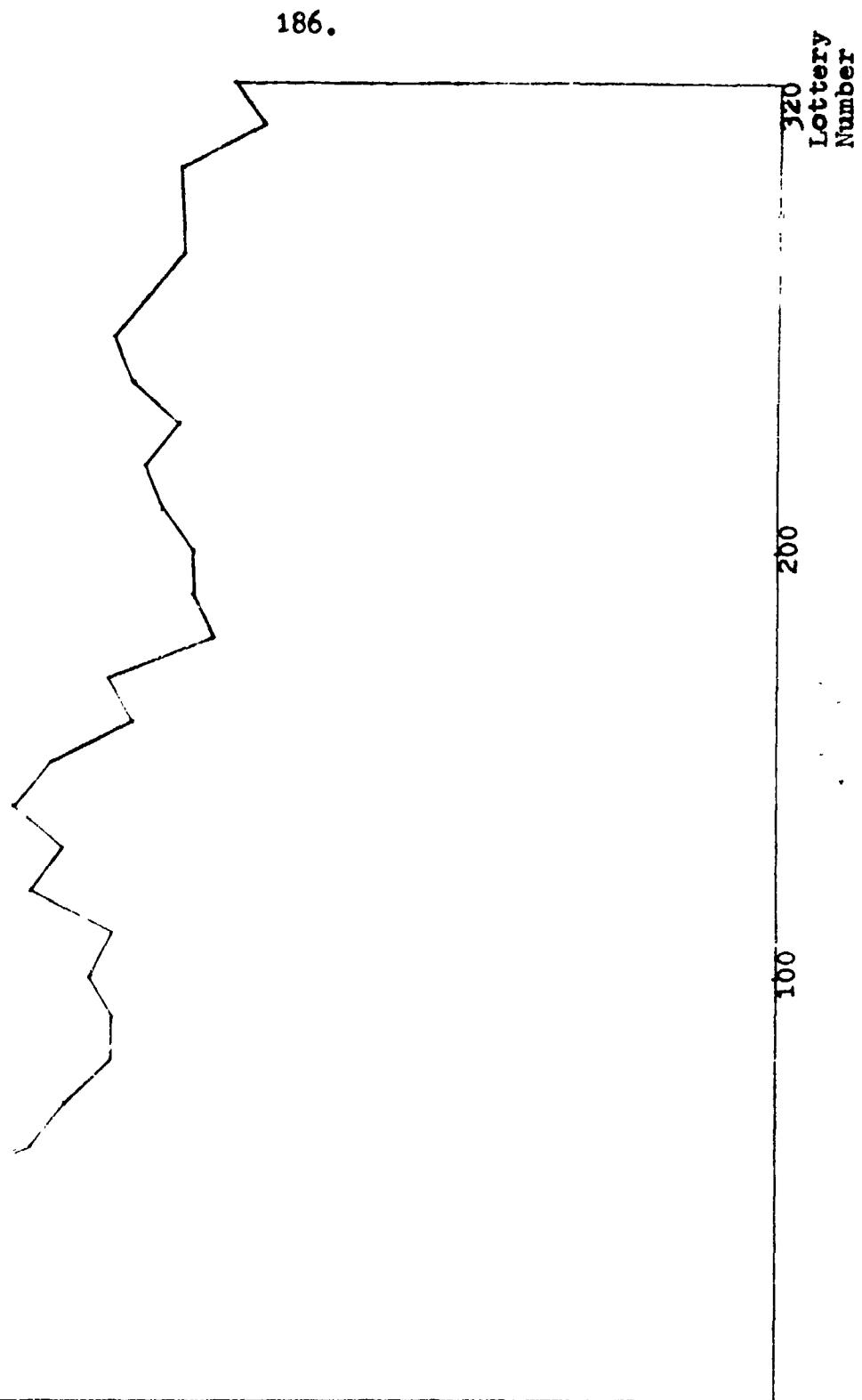
Fig. B5 - Relative Number of Applicants Applying from Each Lottery Number Group, Individuals with Mechanical Percentile Scores 80-95 (n=2025)

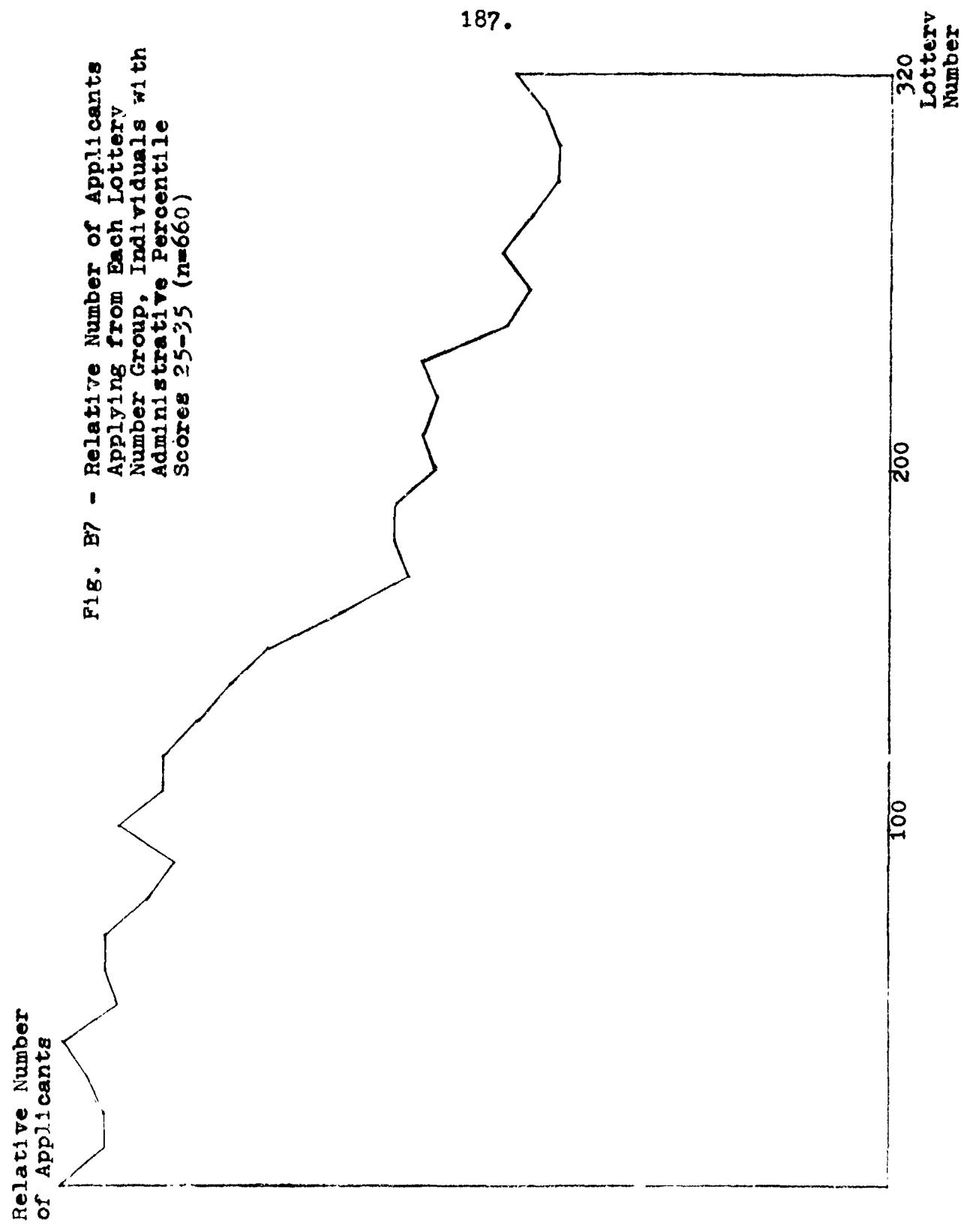
185.



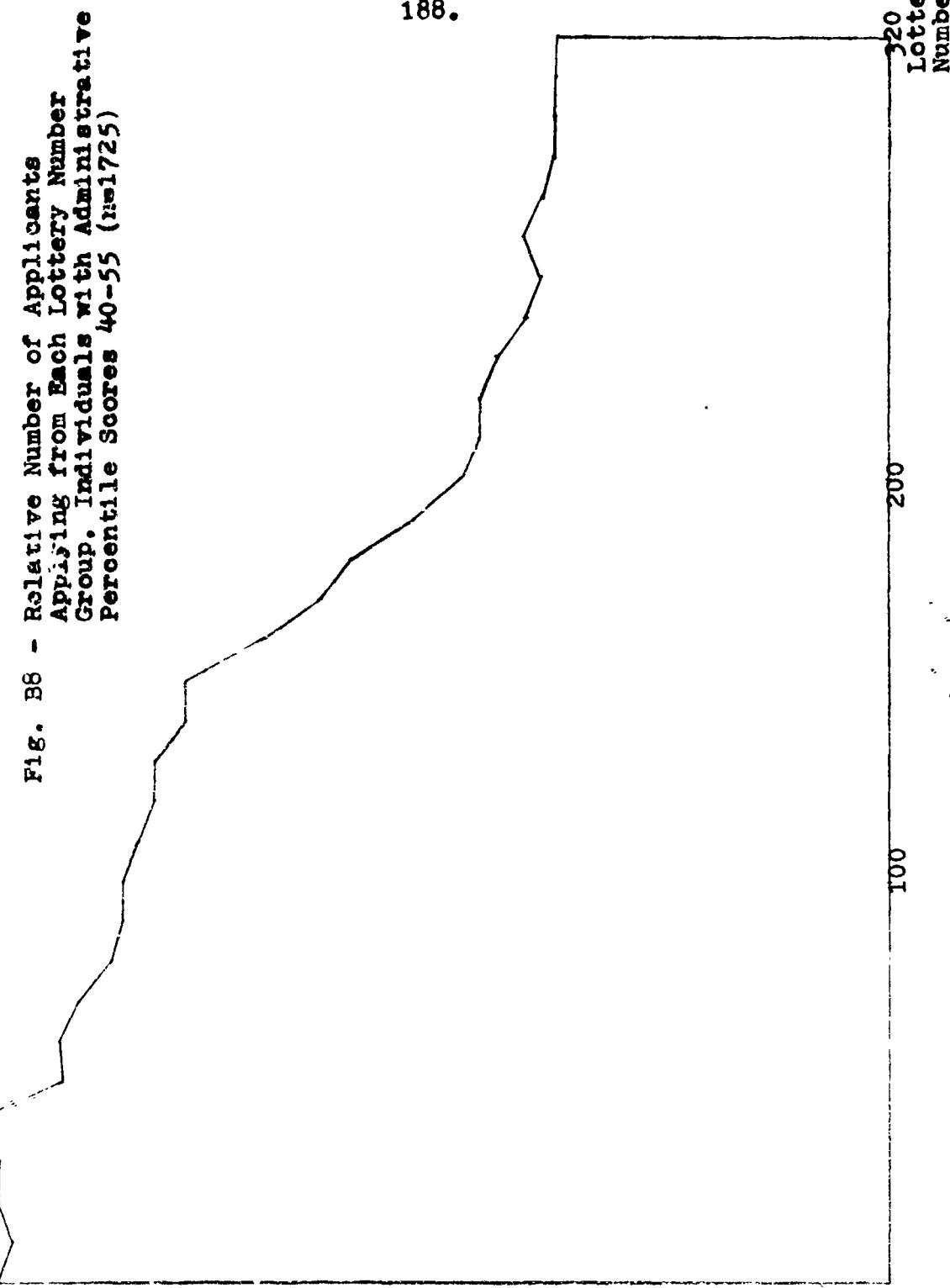
Relative Number  
of Applicants

Fig. B6 - Relative Number of Applicants  
Applying from Each Lottery Number  
Group. Individuals with Administrative  
Scores 01-20 (n=696)

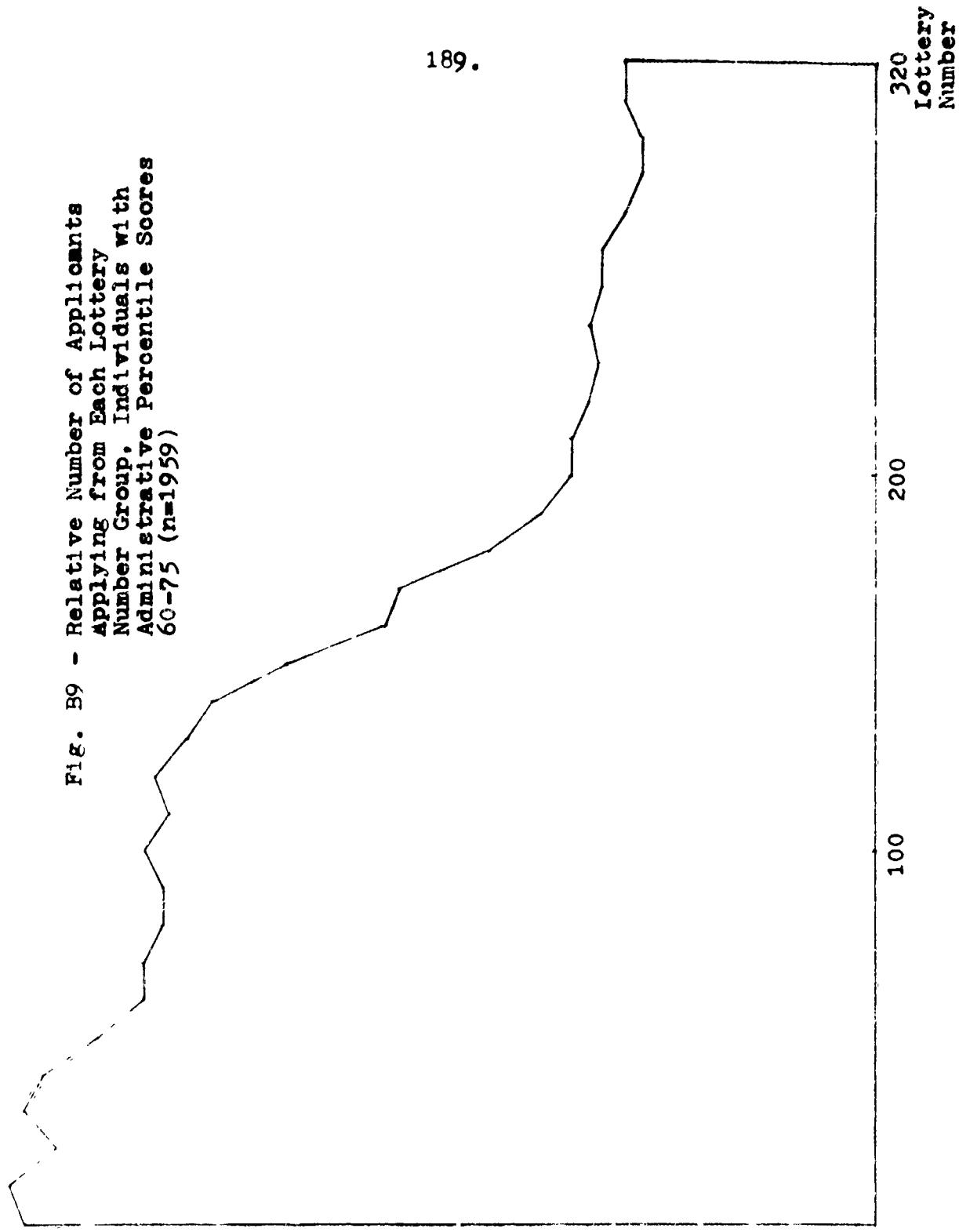


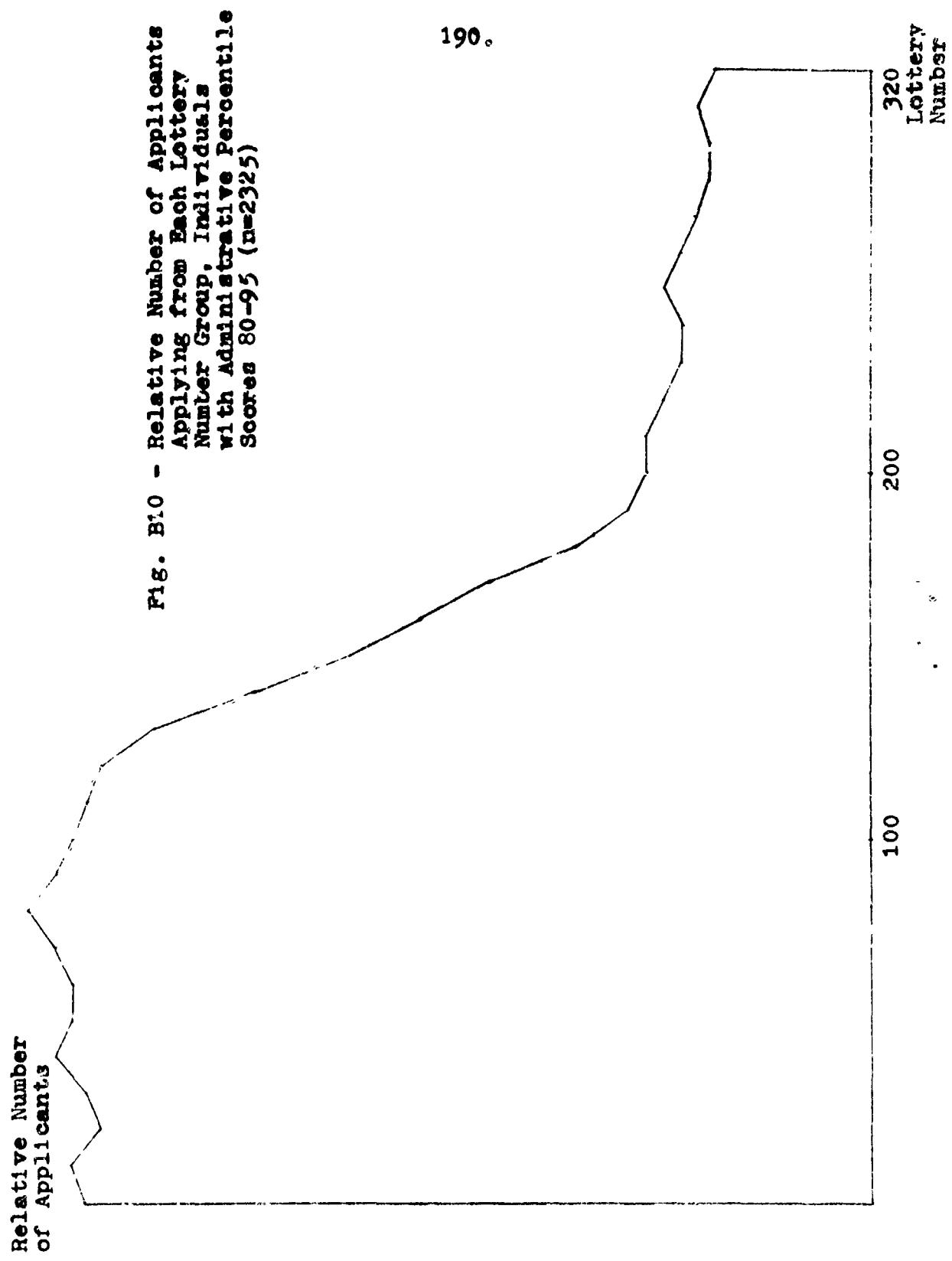


Relative Number  
of Applicants



Relative Number  
of Applicants



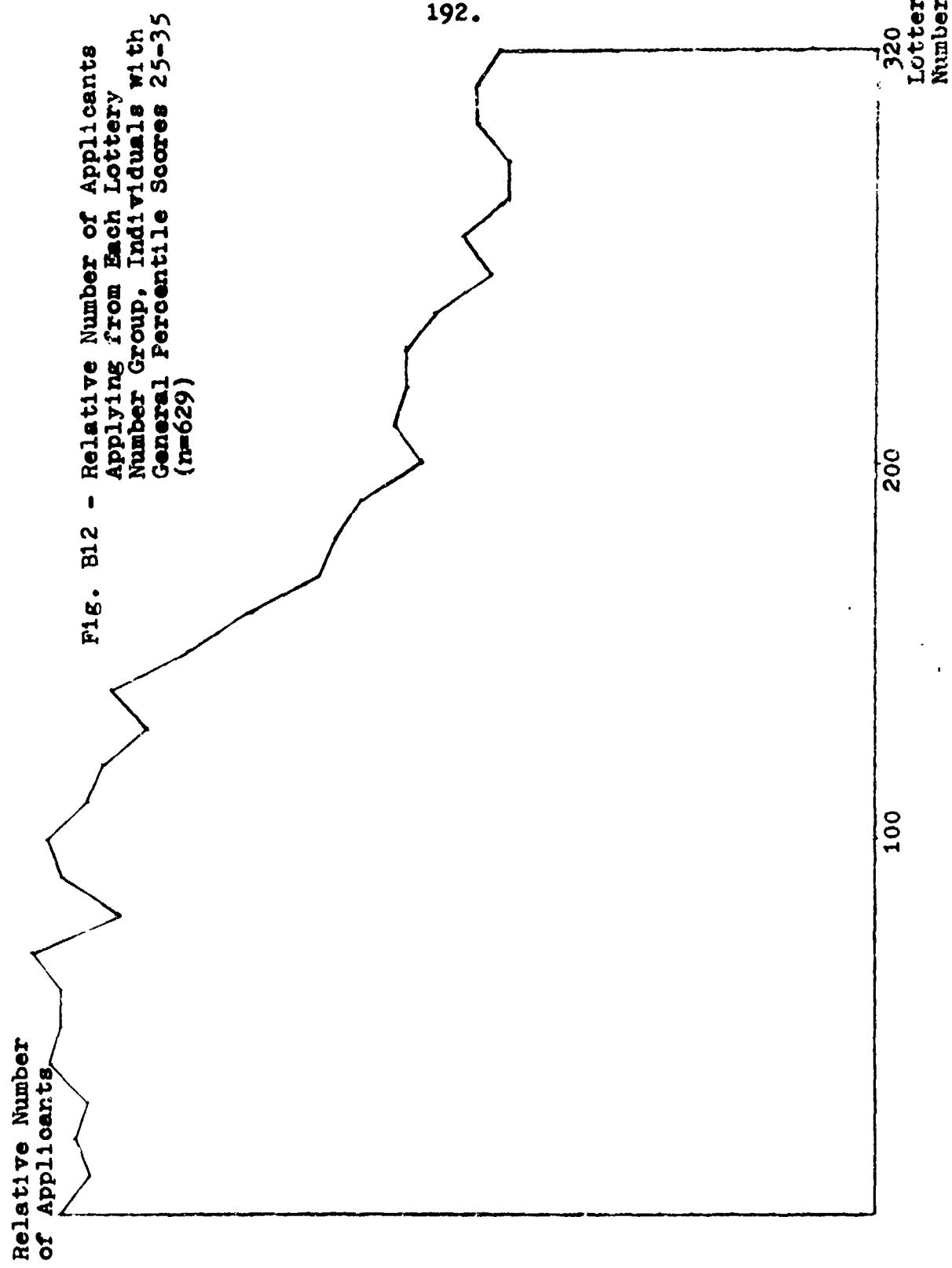


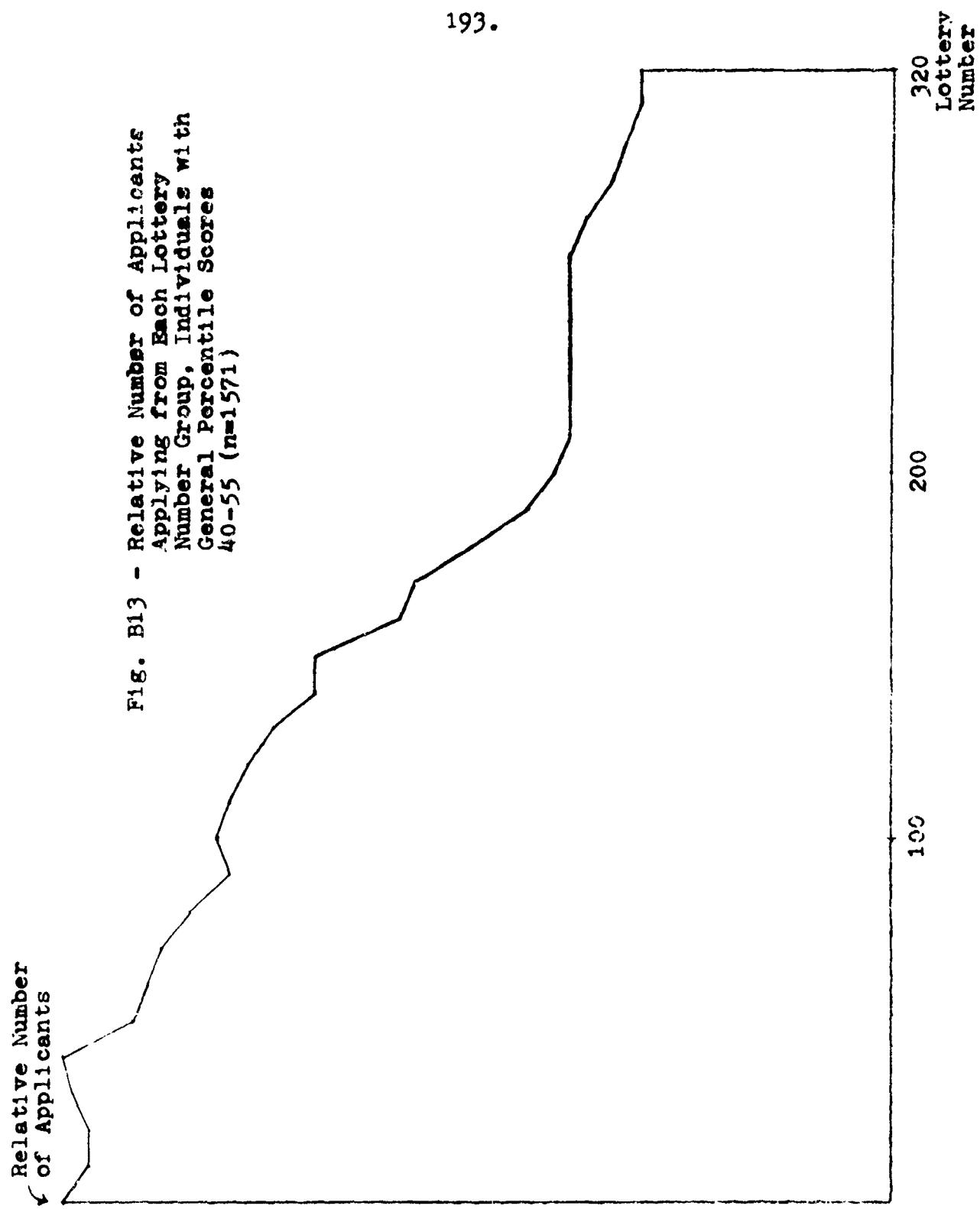
Relative Number of Applicants

Fig. B11 - Relative Number of Applicants Applying from Each Lottery Number Group. Individuals with General Percentile Scores 01-20 (n=600)

191.

320  
Lottery  
Number200  
100





Relative Number  
of Applicants

Fig. B14 - Relative Number of Applicants Applying from Each Lottery Number Group. Individuals with General Percentile Scores 6C-75 (n=2194)

194.

320  
200  
100  
Lottery Number

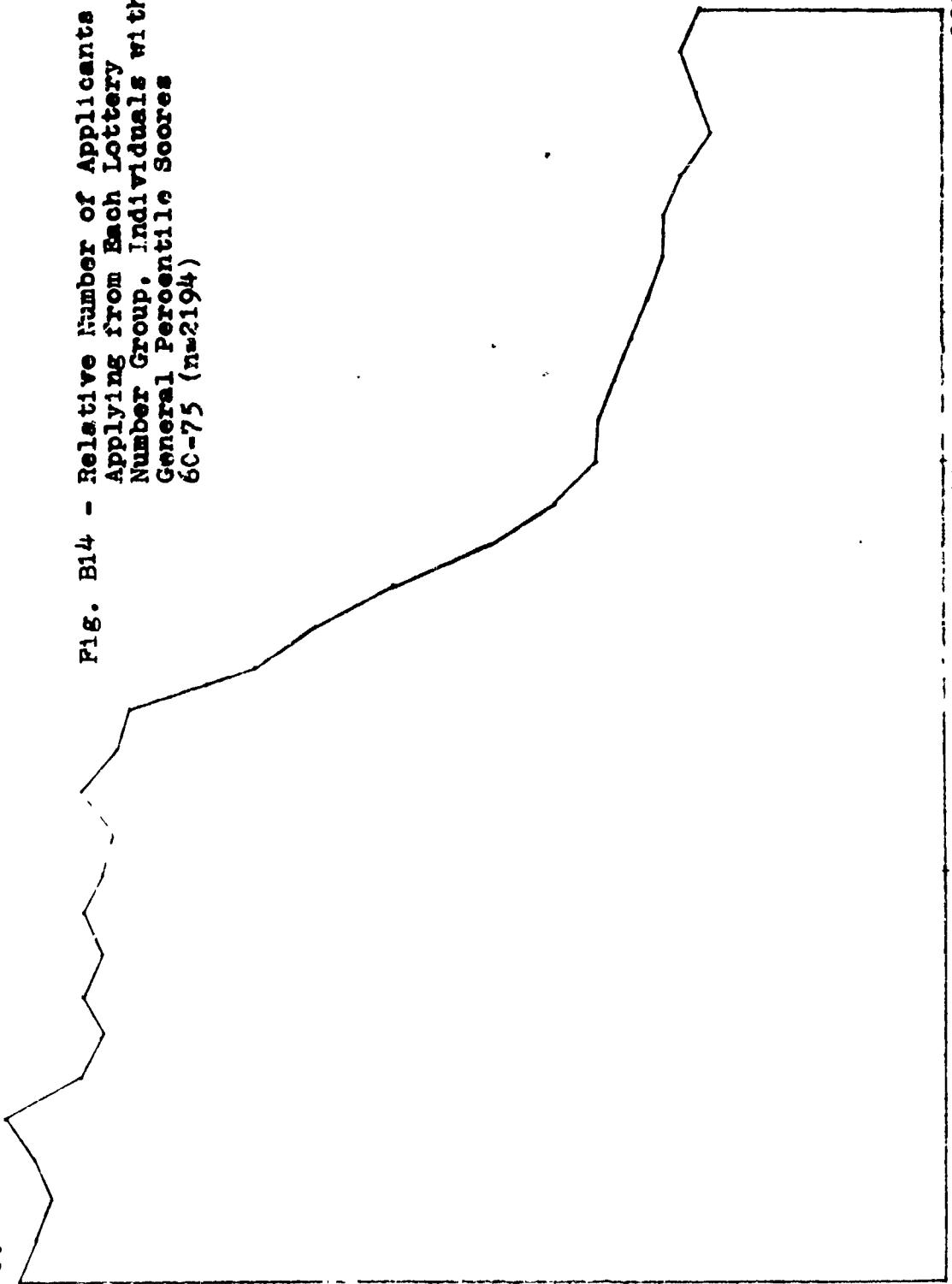
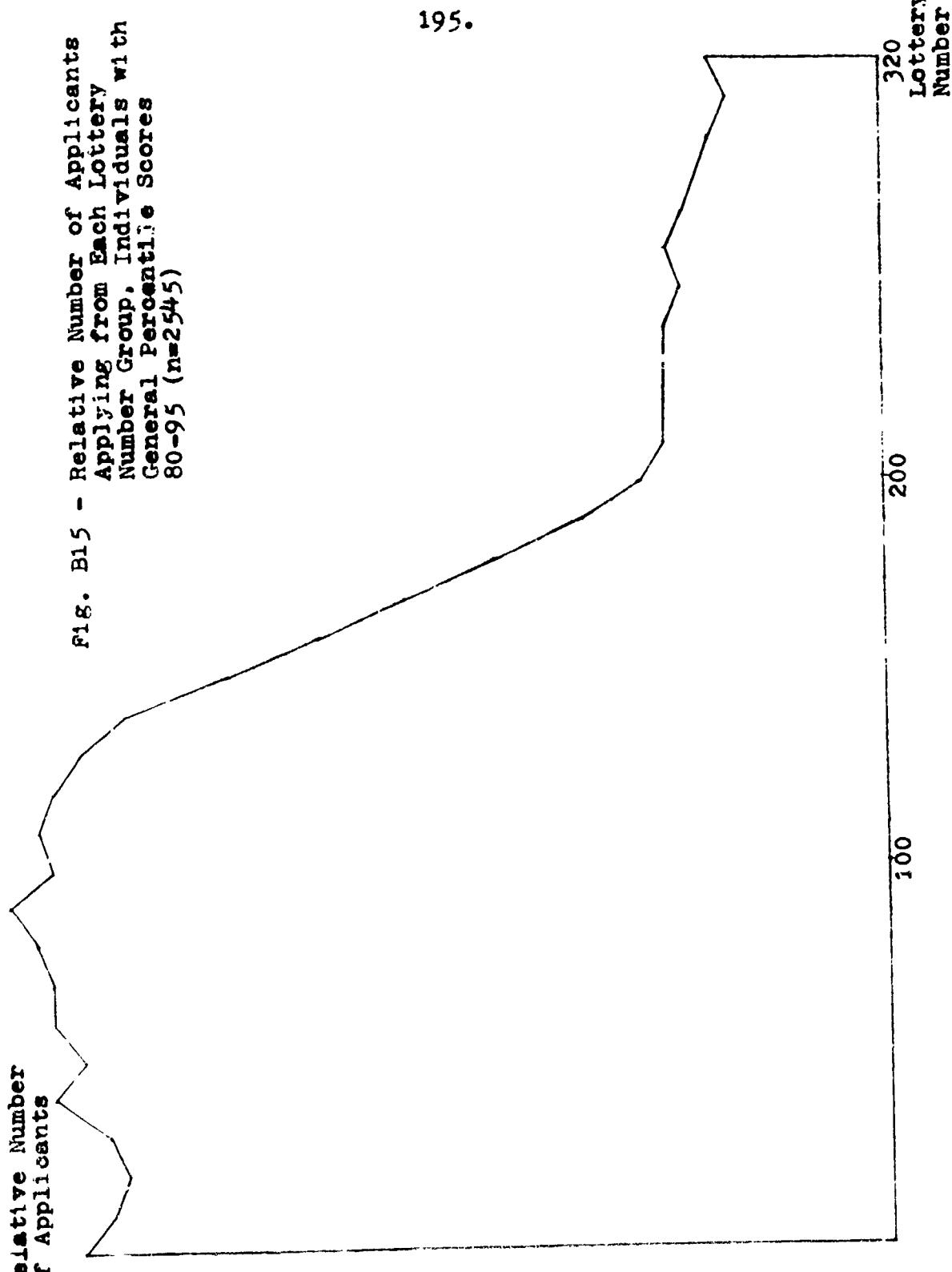
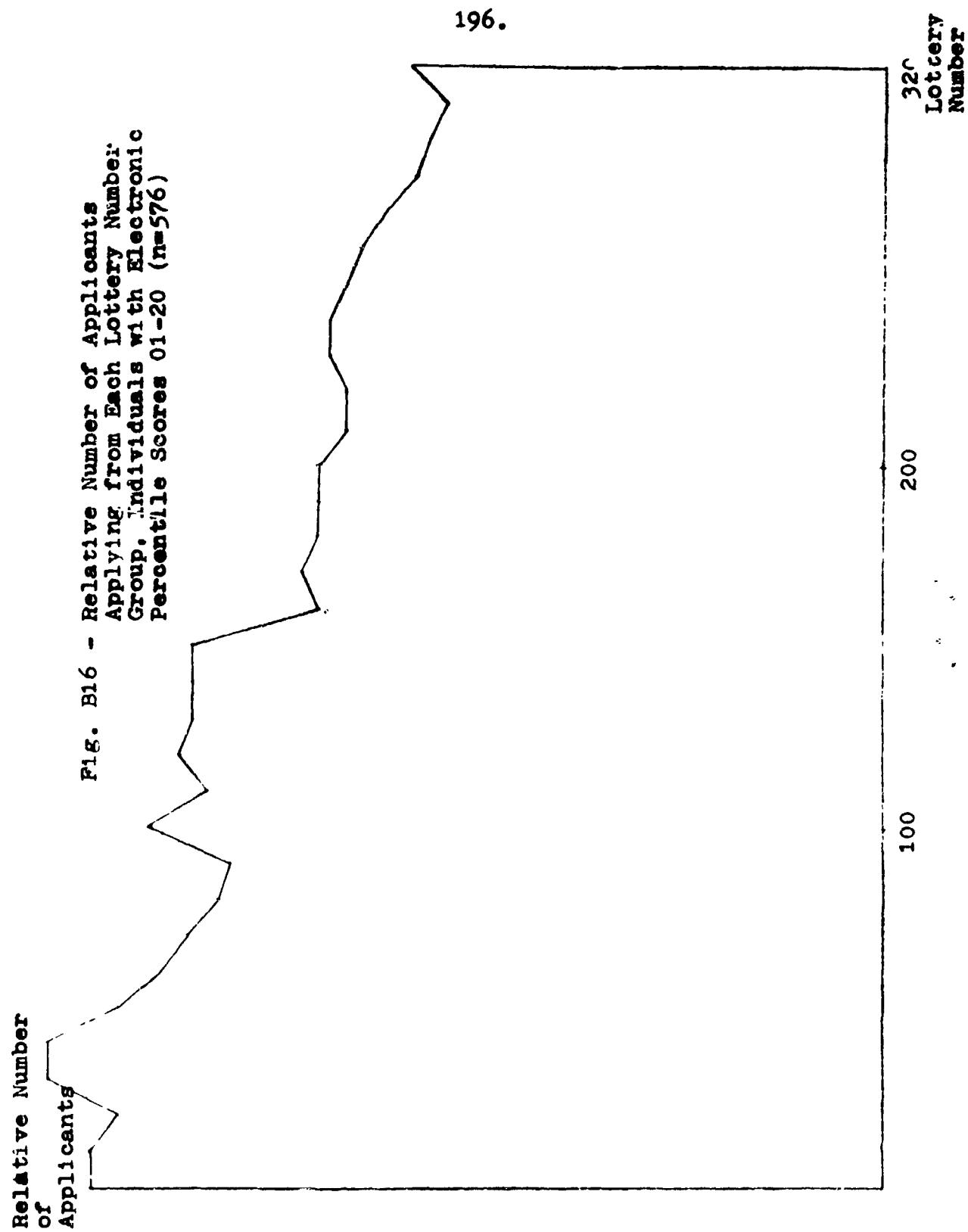
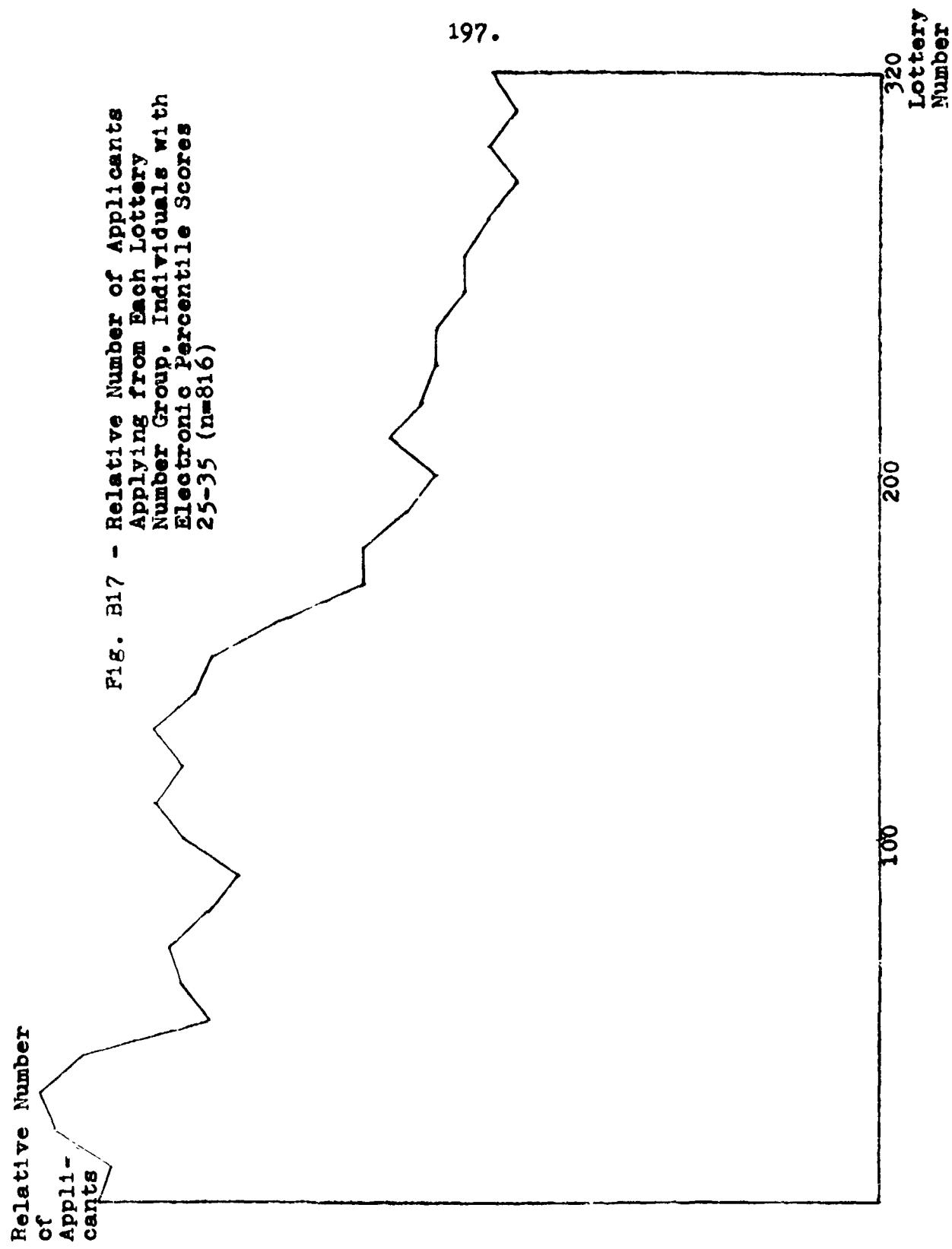


Fig. B15 - Relative Number of Applicants Applying from Each Lottery Number Group, Individuals with General Percentile Scores 80-95 (n=2545)







Relative Number of  
Applicants

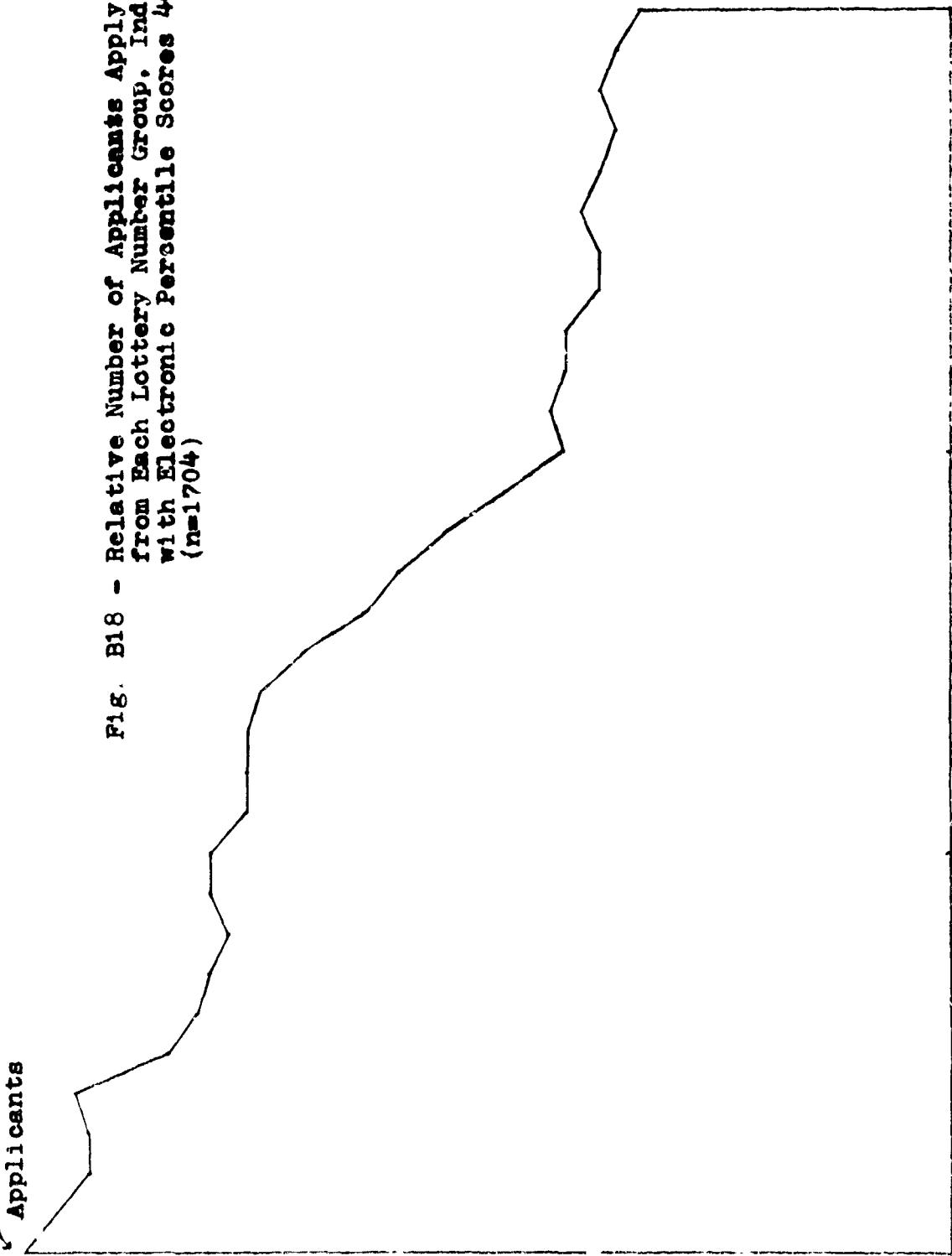
Fig. B18 - Relative Number of Applicants Applying  
from Each Lottery Number Group. Individuals  
with Electronic Percentile Scores 40-55  
(n=1704)

198.

320  
Lottery  
Number

200

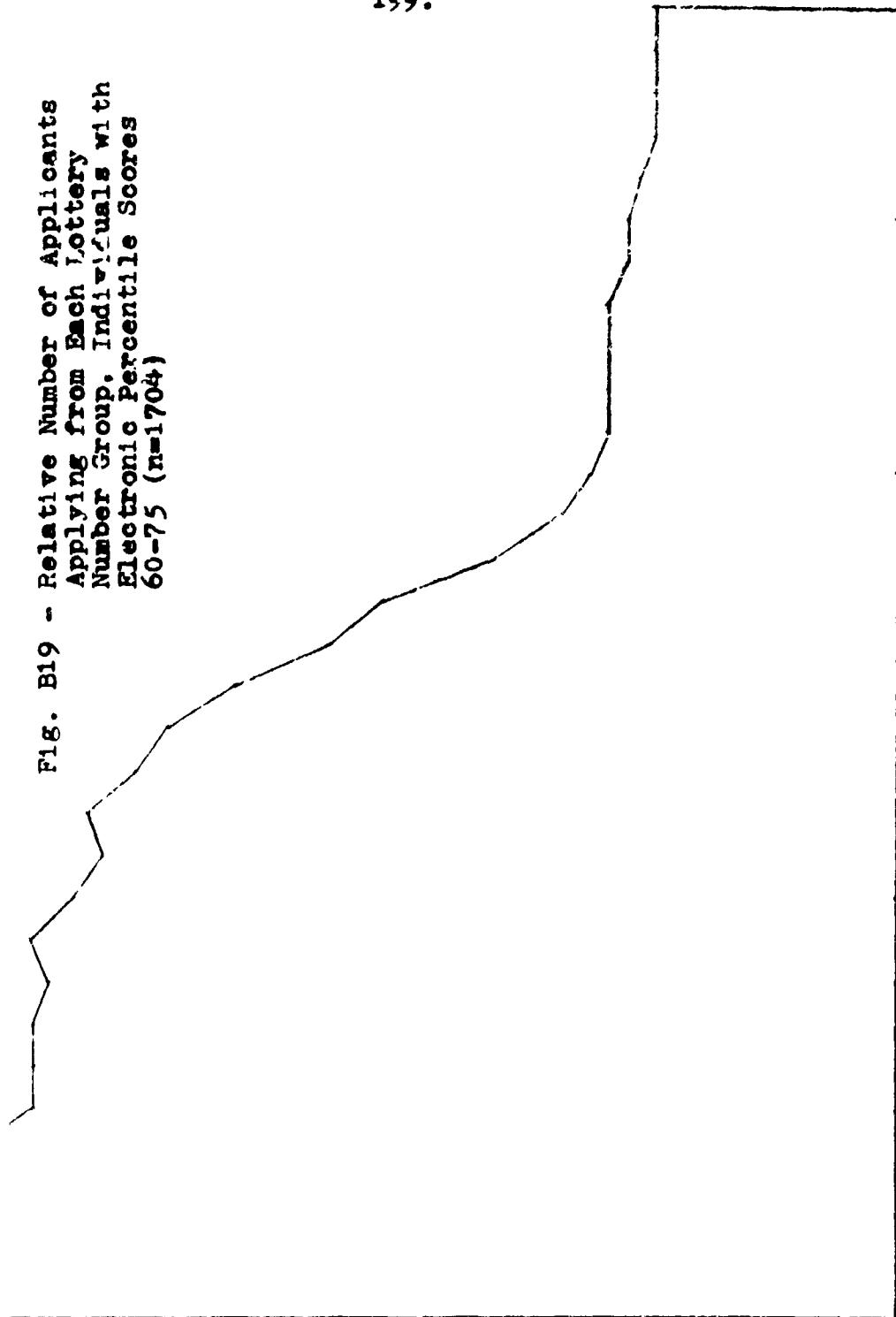
100



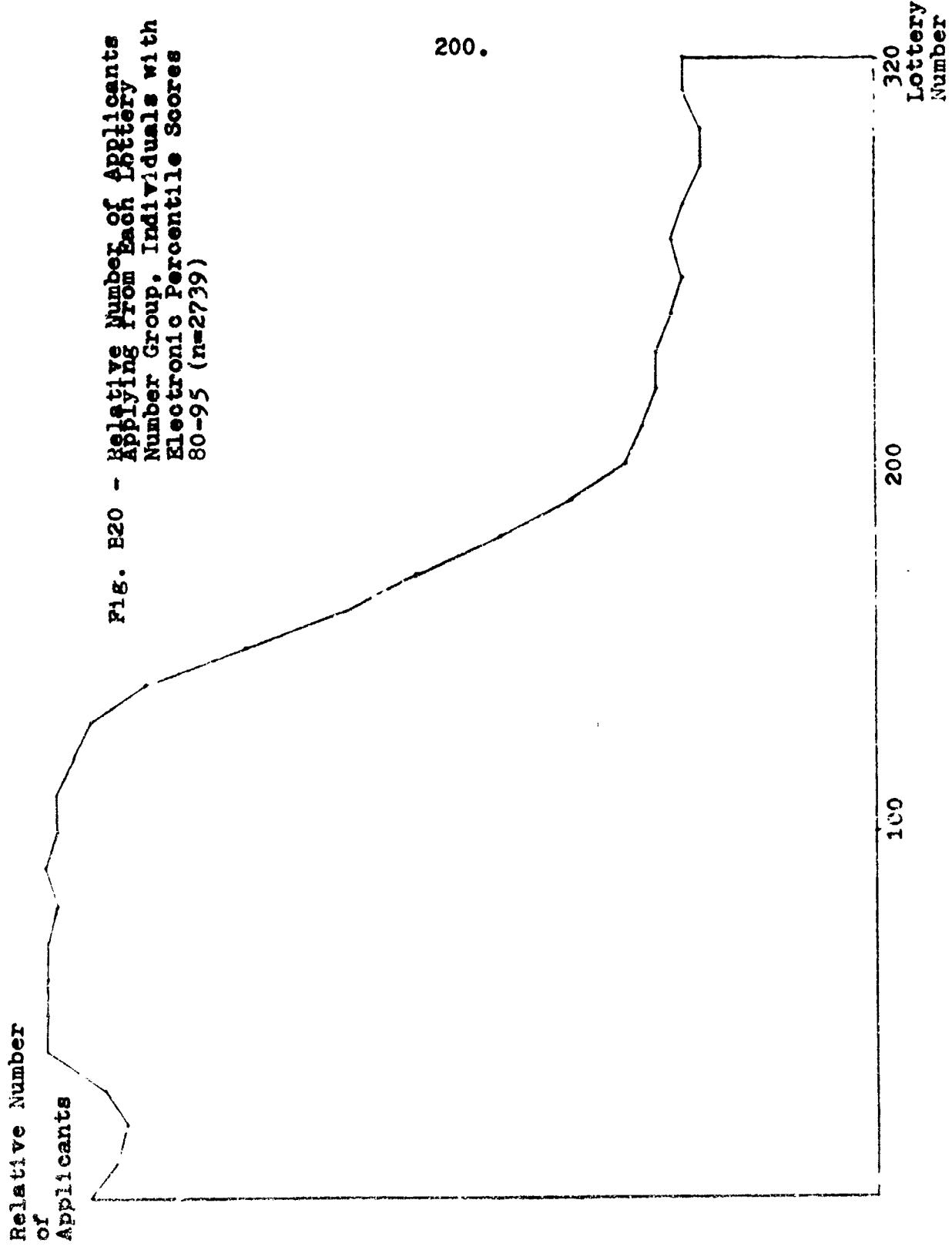
Relative Number  
of Applicants

F18. B19 - Relative Number of Applicants  
Applying from Each Lottery  
Number Group. Individuals with  
Electronic Percentile Scores  
60-75 (n=1704)

199.



200  
100  
520  
Lottery  
Number



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